REPORT

ON

FISH-BREEDING OPERATIONS

IN

CANADA

1906

BY

PROFESSOR E. E. PRINCE

Dominion Commissioner of Fisheries

OTTAWA
GOVERNMENT PRINTING BUREAU
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REPORT OF PROFESSOR EDWARD E. PRINCE, COMMISSIONER AND GENERAL INSPECTOR OF FISHERIES FOR THE DOMINION OF CANADA.

To the Honourable L. P. BRODEUR,
Minister of Marine and Fisheries,
Ottawa.

OTTAWA, October 15, 1906.

SIR,—I have the honour to submit my twelfth annual report upon the operations carried on in connection with the artificial propagation and transplantation of valuable kinds of fish, native to the waters of the Dominion. In my report last year, I made special reference to the remarkable expansion of the hatchery work under the auspices of the Dominion Government. I pointed out that, in a period covering the last thirty years, the number of hatching establishments had more than quintupled. As a matter of fact, with the new hatcheries whose erection is either completed or in an advanced state, the department has now no less than thirty-two institutions devoted to the important object of incubating the eggs of valuable species of commercial and game fish; and attached to many of them are rearing tanks and retaining ponds, where the young fish are cared for and protected until they are some months old, or, in certain cases, until one to three years old. The Lake Lester ponds, province of Quebec, have been operated successfully as before, while the black bass ponds, on the Bay of Quinte, near Belleville, yielded an ample supply of healthy young bass. One of the important features of the past season was the completion of the first shad hatchery, on the shores of the Bay of Fundy, near Windsor, N.S., while the selection and preparation of a new salmon retaining pond to replace the old-established tidal retaining pond for parent salmon, at Carleton, N.B., has been a matter of great moment in the fish-culture scheme carried out by the department. The retention of salmon, taken in June and July, mainly from the net fishermen, or from departmental fishing stations, and kept in tidal water until October and November when they are matured and ripe for purposes of artificial propagation, has been an unquestionable success. When the late Mr. Wilmot tried it for the first time at Tadousac, in 1875, grave doubts were expressed as to the ultimate success of the experiment, but the fish remained in the salt-water inclosure in perfect condition, and the plan was extended; and the well-known salmon-pond at the mouth of the St. John River, N.B., has been a most valuable and reliable means of supplying a number of hatcheries with an abundance of healthy salmon eggs. The new pond at St. John, will, it is hoped, prove as reliable as the old pond which was an invaluable adjunct to the hatchery system of the maritime provinces.

Last year the total output of fry of all kinds showed a grand total of 627,541,000, exclusive of the yield of young black bass and brook trout, and of lobsters hatched in the sea from the 52,772 'berried' or egg-berring female lobsters liberated from the Gabarus lobster ponds operated as explained in my last year's report by arrangement with Mr. H. E. Baker, a prominent Cape Breton lobster canner. This year the lobster ponds at Fourchu contained in the course of the season the total of 42,066 egg-bearing lobsters, and after the conclusion of the fishing season these lobsters were liberated in the open sea and their eggs were hatched by the parent fish under natural conditions; the young fry thus scattered over the areas off-shore, which are Nature's nursery for these minute crustaceans.

During the season of 1906 a grand total of no less than 653,052,000 fry of various kinds of fresh water and marine fishes were planted from the Dominion Government hatcheries.

The table which follows shows the various species of fish and the total number of each kind respectively hatched and successfully planted from the different establishments operated by the department, during the year.

Atlantic salmon *(Salmo salar)*	11,705,000
B.C. salmon	78,025,000
Speckled trout *(Salvelinus fontinalis)*	738,000
Salmon trout *(Salvelinus namaycush)*	3,147,000
Grey trout *(Cristivoner namaycush)*	437,000
Pickerel or Doré *(Stizostedion vitreum)*	25,000,000
Lake whitefish *(Coregonus clupeiformis)*	63,000,000
Lobster *(Homarus americanus)*	471,000,000
Total	653,052,000

For facility of reference the detailed table below specifies the name and location of each hatchery, also the quantities of young fish and of eggs in an advanced condition snpplied by each establishment respectively, and the species of fry or the kind of eggs so distributed during the season.

Number.	Name of Hatchery.	Number of Fry distributed.	Number of Eggs sent to other Hatcheries.	Species of fish.
1	Ottawa, Ont	812,000	100,000	Salmon Trout.
	"	67,000		Gray Trout.
	"	120,000		Atlantic Salmon
	"	124,000		Speckled Trout.
2	Newcastle, Ont	1,550,000		Salmon Trout.
3	Sandwich, Ont	63,000,000		Whitefish.
	"	25,000,000		Pickerel.
4	Gaspé, P. Q	1,100,000		Atlantic Salmon.
5	Tadousac, P.Q	2,435,000		" "
6	Lac Tremblant	555,000		Salmon Trout
7	St. Alexis, P.Q	493,000	150,000	Speckled Trout.
8	Magog, P.Q	165,000	250,000	Salmon Trout.
	"	70,000		Speckled Trout.
	"	370,000		Gray Trout.
	"	20,000		Atlantic Salmon.
9	Bedford, N.S	1,000,000		" "
	"	51,000		Speckled Trout.
	"	20,000		Salmon Trout.
10	Margaree, N.S	910,000		Atlantic Salmon.
11	Windsor, N.S	575,009		" "
12	Bay View, N.S	118,000,000		Lobsters.
13	Canso, N.S	71,000,000		"
14	Miramichi, N.B	1,650,000	650,000	Atlantic Salmon.
15	Restigouche, N.B	1,575.000		" "
	"	45,000		Salmon Trout.
16	Grand Falls	1,350,000		Atlantic Salmon.
17	Shemogue. N.B	122,000,000		Lobsters.
18	Shippegan, N.B	70,000,000		"
19	Charlottetown	90,000,000		"
20	Kelly's Pond	720.000		Atlantic Salmon.
*21	Selkirk, Man			Whitefish.
*22	Berens River, Man			"
23	Fraser River, B.C	9,130,000		B. C. Salmon.
24	Granite Creek, B.C	10,888,000	4,500,000	"
25	Skeena River, B.C	3,784,000		"
26	Harrison Lake, B.C	28,773,000		"
27	Nimpkish, B.C	4,873,400		"
28	Pemberton, B.C	17,450,000	8,833,000	"
29	Rivers Inlet, B.C	8,000,000		"

* Not in operation last year.

FISH–

Statement showing the places where and the years in which the Dominion fish establishment annually since the commencement

Number.	Year.	Ontario.			Quebec.		
		Newcastle.	Sandwich.	Ottawa.	Magog.	Tadousac.	Gaspé.
		Fry.	Fry.	Fry.	Fry.	Fry.	Fry.
1	1868–73	1,070,000					
2	1874	350,000					
3	1875	650,000				60,000	110,000
4	1876	700,000	8,000,000			150,000	50,000
5	1877	1,300,000	8,000,000			1,180,000	1,051,000
6	1878	2,605,000	20,000,000			707,000	650,000
7	1879	2,602,700	12,000,000			1,250,000	1,597,000
8	1880	1,923,000	13,500,000			1,155,000	730,000
9	1881	3,300,000	16,000,000		200,000	334,000	500,000
10	1882	4,841,000	44,000,000		975,000	660,000	530,000
11	1883	6,053,000	72,000,000		250,000	995,000	520,000
12	1884	8,800,000	37,000,000		100,000	985,000	859,000
13	1885	5,700,000	68,000,000		300,000	720,000	290,000
14	1886	6,451,000	57,000,000		1,400,000	1,627,000	576,000
15	1887	5,130,000	56,500,000		675,000	900,000	630,000
16	1888	8,076,000	56,000,000		3,475,000	850,000	800,000
17	1889	5,846,500	21,000,000		2,800,000	1,600,000	450,000
18	1890	7,736,000	52,000,000	5,732,000	2,875,000	1,700,000	806,000
19	1891	7,807,500	75,000,000	7,043,000	3,050,000	1,300,000	1,000,000
20	1892	4,823,000	44,500,000	4,909,000	2,400,000	624,000	965,000
21	1893	9,835,000	68,000,000	6,208,000	3,600,000	2,060,000	910,000
22	1894	6,000,000	47,000,000	4,480,000	2,035,000	1,975,000	850,000
23	1895	6,000,000	73,000,000	3,210,000	3,350,000	2,060,000	675,000
24	1896	5,200,000	61,000,000	3,950,000	3,400,000	2,500,000	300,000
25	1897	4,200,000	72,000,000	4,100,000	4,500,000	3,272,000	1,100,000
26	1898	4,325,000	71,000,000	3,020,000	3,100,000	2,200,000	
27	1899	4,050,000	73,000,000	3,700,000	3,098,000	2,125,000	
28	1900	5,175,000	90,000,000	3,450,000	3,099,000	1,400,000	
29	1901	5,900,000	67,000,000	3,410,000	3,135,000	2,960,000	
30	1902	650,000	100,000,000	1,245,000	935,000	2,730,000	734,000
31	1903	2,500,000	90,000,000	1,201,000	885,000	1,625,000	830,000
32	1904	1,475,000	75,000,000	877,000	283,000	2,615,000	1,520,000
33	1905	1,480,000	106,000,000	1,103,000	1,098,000	1,550,000	1,100,000
34	1906	1,550,000	88,000,000	1,123,000	875,000	2,435,000	1,100,000
	Totals	144,104,700	1,741,500,000	58,761,000	51,893,000	48,274,000	21,233,000

BREEDING.

hatcheries have been erected ; also the number of fry distributed from each of operations, including the year 1906.

Quebec—*Con.*		New Brunswick.					Number.
St. Alexis des Monts.	Mont Tremblant.	Restigouche.	Miramichi.	St. John River.	Lobster Hatchery, Shemogue.	Lobster Hatchery, Shippegan.	
Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	
.....	.....	.....	.....	.....	.....	.....	1
.....	.....	100,000	60,000	.....	.....	.....	2
.....	.....	600,000	150,000	.....	.....	.....	3
.....	.....	300,000	60,000	.....	.....	.....	4
.....	.....	600,000	320,000	.....	.....	.....	5
.....	.....	1,015,000	665,000	.....	.....	.....	6
.....	.....	1,470,000	1,025,000	.....	.....	.....	7
.....	.....	1,500,000	805,000	170,600	.....	.....	8
.....	.....	740,000	770,000	50,000	.....	.....	9
.....	.....	1,400,000	640,000	588,000	.....	.....	10
.....	.....	300,000	925,000	72,600	.....	.....	11
.....	.....	940,000	795,000	811,000	.....	.....	12
.....	.....	660,000	900,000	155,000	.....	.....	13
.....	.....	1,380,000	945,000	2,181,000	.....	.....	14
.....	.....	1,500,000	900,000	2,479,000	.....	.....	15
.....	.....	1,720,000	1,290,000	4,142,000	.....	.....	16
.....	.....	1,280,000	850,000	3,570,000	.....	.....	17
.....	.....	2,396,000	1,022,000	3,492,000	.....	.....	18
.....	.....	1,750,000	1,503,000	3,165,000	.....	.....	19
.....	.....	1,240,000	1,310,000	2,378,000	.....	.....	20
.....	.....	883,000	975,000	3,299,000	.....	.....	21
.....	.....	1,080,000	1,010,000	4,096,000	.....	.....	22
.....	.....	2,885,000	1,200,000	4,060,000	.....	.....	23
.....	.....	1,250,000	1,436,000	4,068,000	.....	.....	24
.....	.....	2,100,000	1,558,000	4,155,000	.....	.....	25
.....	.....	1,135,000	1,557,000	3,290,000	.....	.....	26
.....	.....	2,025,000	1,605,000	3,980,000	.....	.....	27
.....	.....	1,125,000	1,620,000	3,957,000	.....	.....	28
.....	.....	1,750,000	1,800,000	3,605,000	.....	.....	29
.....	.....	2,310,000	1,700,000	998,000	.....	.....	30
.....	.....	2,052,000	1,000,000	648,000	17,000,000	.....	31
125,000	.....	2,525,000	1,500,000	909,000	52,000,000	50,000,000	32
298,000	570,000	2,333,000	1,400,000	807,000	100,000,000	100,000,000	33
493,000	555,000	1,620,000	1,650,000	1,350,000	122,000,000	70,000,000	34
916,000	1,125,000	45,964,000	34,940,000	62,476,000	291,000,000	220,000,000	

FISH–

STATEMENT showing the Places where and the Years in which the

Number.	Year.	Nova Scotia.						P. E. Island.	
		Bedford.	Sydney.	Margaree.	Windsor.	Lobster Hatchery, Bay View.	Canso.	Kelly's Pond.	Lobster Hatchery, Charlottetown
		Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	Fry.
1	1868–73								
2	1874								
3	1875								
4	1876	395,000							
5	1877	1,000,000							
6	1878	1,400,000							
7	1879	1,740,000							
8	1880	730,000							500,000
9	1881	680,000							375,000
10	1882	850,000	315,000						1,000,000
11	1883	800,000	659,000						1,210,000
12	1884	1,000,000	853,000						1,000,000
13	1885	670,000	772,000						1,100,000
14	1886	950,000	1,179,000						400,000
15	1887	4,230,000	1,415,000						500,000
16	1888	4,390,000	1,559,000						Output of
17	1889	3,850,000	2,034,000						Dunk R.
18	1890	3,860,000	1,953,000						Hatche-
19	1891	2,550,000	1,000,000			7,000,000			ry, now
20	1892	2,620,000	690,000			63,500,000			closed.
21	1893	3,180,000				153,600,000			
22	1894	3,805,000	288,000			160,000,000			
23	1895	3,815,000	195,000			168,200,000			
24	1896	4,225,000	243,500			100,000,000			
25	1897	5,450,000	496,000			90,000,000			
26	1898	3,000,000				85,000,000			
27	1899	4,025,000				100,000,000			
28	1900	3,970,000				120,000,000			
29	1901	3,980,000				110,000,000			
30	1902	960,000		95,000		120,000,000			
31	1903	710,000		600,000		164,000,000			
32	1904	1,213,000		562,500		175,000,000			60,000,000
33	1905	800,000		799,500		155,000,000	8,000,000		100,000,000
34	1906	1,071,000		910,000	575,000	118,000,000	71,000,000	720,000	90,000,000
		71,999,000	13,651,500	2,967,000	575,000	1,889,300,000	79,000,000	720,000	256,085,000

BREEDING.

several Fish Hatcheries have been erected, &c.—*Concluded.*

British Columbia.							Manitoba.	Totals.	Number.
Fraser River	Harrison Lake.	Granite Creek, Sicamous.	L. Lakelse Skeena River.	Pemberton.	Rivers Inlet.	Nimpkish River.	Selkirk.		
Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	Fry.	
.....	.....	.....	.....	.....	.....	.....	.....	1,070,000	1
.....	.....	.....	.....	.....	.....	.....	.....	510,000	2
.....	.....	.....	.....	.....	.....	.....	.....	1,570,000	3
.....	.....	.....	.....	.....	.....	.....	.....	9,655,000	4
.....	.....	.....	.....	.....	.....	.....	.....	13,451,000	5
.....	.....	.....	.....	.....	.....	.....	.....	27,042,000	6
.....	.....	.....	.....	.....	.....	.....	.....	21,684,700	7
.....	.....	.....	.....	.....	.....	.....	.....	21,013,600	8
.....	.....	.....	.....	.....	.....	.....	.....	22,949,000	9
.....	.....	.....	.....	.....	.....	.....	.....	55,799,000	10
.....	.....	.....	.....	.....	.....	.....	.....	83,784,600	11
.....	.....	.....	.....	.....	.....	.....	.....	53,143,000	12
1,800,000	.....	.....	.....	.....	.....	.....	.....	81,067,000	13
2,625,000	.....	.....	.....	.....	.....	.....	.....	76,714,000	14
4,414,000	.....	.....	.....	.....	.....	.....	.....	79,273,000	15
5,807,000	.....	.....	.....	.....	.....	.....	.....	88,109,000	16
4,419,000	.....	.....	.....	.....	.....	.....	.....	47,699,500	17
6,640,000	.....	.....	.....	.....	.....	.....	.....	89,212,000	10
3,603,800	.....	.....	.....	.....	.....	.....	.....	115,772,300	11
6,000,000	.....	.....	.....	.....	.....	.....	.....	135,959,500	22
5,764,000	.....	.....	.....	.....	.....	.....	.....	258,314,000	23
7,800,000	.....	.....	.....	.....	.....	.....	14,500,000	254,919,000	24
6,390,000	.....	.....	.....	.....	.....	.....	19,000,000	294,040,000	25
10,393,000	.....	.....	.....	.....	.....	.....	4,500,000	202,459,500	26
5,928,000	.....	.....	.....	.....	.....	.....	.....	198,859,000	27
5,850,000	.....	.....	.....	.....	.....	.....	9,000,000	192,477,000	28
4,742,000	.....	.....	.....	.....	.....	.....	20,000,000	222,350,000	29
6,200,000	.....	.....	.....	.....	.....	.....	32,000,000	271,996,000	28
.....	.....	.....	.....	.....	.....	.....	.....	203,540,000	29
9,214,000	.....	6,760,000	.....	.....	.....	.....	23,000,000	271,301,000	30
9,573,000	.....	4,866,500	3,450,000	.....	.....	1,636,000	12,000,000	314,576,500	31
6,584,000	.....	3,074,000	4,000,000	.....	.....	2,496,000	31,500,000	473,258,500	32
2,550,000	6,505,000	4,000,000	3,767,900	.....	.....	2,800,000	25,500,000	627,541,400	33
9,130,000	28,775,000	10,888,000	3,784,000	17,450,000	8,000,000	4,873,400	.....	657,925,400	34
125,426,800	35,278,000	29,588,500	15,001,900	17,450,000	8,000,000	11,805,400	191,000,000	5,470,035,000	

Further details as to the working of each hatchery will be found in Superintendent F. H. Cunningham's report, which follows my present report. Mr. Cunningham has been very fully engaged in visiting sites suggested for new hatcheries, in arranging for the erection of other hatcheries which have been authorized, and in inspecting a considerable number of the hatcheries while in the midst of their operations. With the continued growth of the fish-breeding system in all parts of the Dominion, it has become impossible to inspect and supervise the various institutions as frequently as is desirable, hence it became necessary to appoint a special officer, Mr. Alexander Finlayson, to perform these imperative duties. I have on several occasions adverted to the services of Mr. Finlayson, and the exceptional qualifications which he possesses in the field of artificial fish-culture, and in the work of regular hatchery inspection, the department will be enabled to keep in more direct touch with the various hatching establishments and the officers in charge and the staffs under them.

For many years the only regular inspection was on the occasion of my systematic tours as Dominion Fisheries Commissioner to the different fishing localities in the most diverse parts of the Dominion. I visited in the course of my official tours every hatchery in operation, but as year after year new buildings were erected any regular inspection became very difficult. With Mr. Cunningham as Superintendent and Mr. Finlayson as Inspector, the necessary supervision will be more effectively accomplished. I took the opportunity while visiting all parts of the British Columbia coast and the upper waters of certain salmon rivers during the past summer, to visit every Dominion hatching establishment on the Pacific coast. I have visited the Bon Accord, Fraser River hatchery, and the establishments at Harrison Lake; Pemberton Meadows, Birkenhead River; Granite Creek, Shuswap Lake, Nimpkish River, near Alert Bay; the remote hatchery at Lakelse Lake, on the Skeena River; and the fine building at O-Wee-Kay-No Lake, Rivers Inlet, the last-named being visited indeed twice, viz., in December last, and again, in July. It is with very great satisfaction that I am able to report most favourably on all these hatcheries. The department is fortunate in having, at each of the institutions referred to, officers in charge of exceptional ability. I found each one intensely interested in his work, work often very arduous and always very responsible, and enthusiastic in producing the best results without excessive expenditures. The residents in the various localities spoke most highly to me about these officers; and about the staffs of assistant officers, employed in the different branches of hatchery work, under the direction of the officers in charge. Some of the hatcheries are situated in places very isolated and remote, where only officers conscientious and enthusiastic in the extreme could be relied upon to produce the splendid and successful results, which I am able to record in my present report. Further, in some of the isolated hatcheries, especially near the head-waters of great rivers, like the chief salmon rivers of British Columbia, the hatchery buildings must be located on sites which, at times, are in danger of mountain slides, or of gigantic freshets and floods. The dams and retaining inclosures, necessary for supplying water, or relieving the overcrowded tanks in the hatchery, are imperilled each season from January to June. It is an important question whether or not hatcheries should not, in all cases, be built in accessible situations, so that the eggs may be brought down from the upper spawning grounds, and the newly hatched fry shipped by scow or canoe, before the spring floods, up to the nearest tributaries or suitable portions of the main river. The young of the various species of Pacific salmon do not remain many months in the upper waters before they descend to the sea, hence it is not material to transport them from the hatcheries to the highest sources of their native rivers. The most important species of B.C. salmon, as is well known, viz., the sockeye or blueback, is hatched, as a rule, in small streams which empty into more or less spacious lakes, and rarely in the main channel of rivers, though I know of many exceptions, and have seen sockeye salmon breeding in creeks which were almost tidal in character, so near to the sea was the source of the stream chosen by the spawning schools. It is hardly necessary to add that in case of an accident or a breakdown, or in case of illness amongst the staff, the results, in the remotely situated hatcheries to which I am making reference, might be very serious. Cases are on the department's records of such mishaps, which are inevitable at times, and only the skill and foresight

of the officer in charge has prevented disaster. Two cases have come to my notice in the Dominion hatcheries recently, in which it was only by efforts almost superhuman that the officers in charge averted loss of fry and injuries to the hatcheries under their care, and had the officers in question not remained continuously at work for two or more days and nights in succession, the results would have not only been unfavourable, but possibly disastrous.

These observations upon the location of hatcheries, and the desirability of selecting accessible locations rather than distant and remote sites, brings up the allied question, 'should fry be always planted on, or close to, the natural spawning areas?' If so, it is clear that hatcheries must be located near the grounds in question. To convey fry from even some of the existing hatcheries, placed as near as may be to the breeding grounds, is, as many of our officers in charge are well aware, a most laborious and difficult task. It has been insisted that young fry should not only be carried up to the highest possible shallow areas, but they should be scattered thinly or 'sown' so that they may not crowd or be massed too numerously together. The fact cannot be ignored that, by a law of nature which it is impossible to overcome, unless by exceptional and often difficult measures, a certain proportion of young fishes are destined to be the food of aquatic animals, birds, &c., and the retention of the small fish until they attain some size, will not save them from that toll which nature provides should be paid by one class of living creatures to other living animals. The fish-culturist must face the fact that a proportion of liberated young fish will inevitably succumb to the conditions of fish-life in the rivers and the sea. One of these conditions being, that small fishes are the natural food of other creatures, including the finny tribes themselves. I have so often, in former reports, dwelt upon the advantages secured by the adoption of the methods of artificial fish-breeding, that I need only refer to the gain which is secured by saving the defenceless eggs from that terrible decimation which they suffer when placed by the parents upon the natural hatching ground. I may quote from my special report, of which a revised reprint, much extended, was published in the department's (Fisheries) report last year:—

'It is plain that if we can secure the eggs from the ripe parent fish and hatch them under the care of experts, the results must infinitely surpass those possible under natural conditions, where a small proportion only can be expected to surmount all the dangers and difficulties of their environment. Let me give an illustration of this waste of eggs on the natural spawning beds—a waste not contrary to natural law, but obedient to the principle of compensation and adjustment, universal in the world of nature. In 1895 I spent some time closely observing certain spawning beds of the Fraser river salmon, commonly called sockeye or blueback. I noticed, not once, but scores of times, pairs of fish busy nesting, the male fish lingering near his partner until she shed a shower of eggs. Just as the eggs were cast into the rapid stream, the male fish had his attention attracted by a rival, and darted with lightning speed to drive him off, both male fish tearing at each other with gaping jaws, armed with formidable teeth, the teeth at this time being of abnormal size. Time after time I saw female fish wasting their eggs in this way, for the eggs deposited in the gravel by the female, while her partner was engaged in a fight twenty or thirty yards away, were unfertilized and would, of course, perish or be eaten by hungry enemies, suckers, trout, &c., which hovered near in hordes.

This loss of naturally spawned eggs is universally admitted, but the crowding on the spawning grounds, or 'redds' as they are called in Britain, proves injurious to the fish, as the fungoid growth, which is so terrible a disease, is transferred from one to the other, if indeed this crowding is not the original cause of the disease. The first great destruction takes place on the 'redds.' Everywhere over these are tiny raised heaps of gravel sheltering the spawn, but the shelter is insufficient to guard it from devouring enemies. These are in the air, on the land, in the water. Many members of the hungry salmonidæ themselves prey on the spawn, and it is difficult to cope with them. Bunches of wild duck and teal seek out the 'redds' in the autumn, and feed on right through the night if not disturbed. Here too, as frequently witnessed, the swan leads her cygnets, and it is known that one of these large birds will destroy nearly a gallon of ova in a day.

If, to the natural loss of enormous quantities of eggs by non-fertilization, be added the depredations of ducks, loons, herons and aquatic birds, not to speak of otters and four-footed enemies, as well as destruction by floods, by mud, gravel and ice, it is easy to see how great are the advantages offered by artificial incubation, and by caring for the eggs in properly equipped hatcheries.'

It is not sufficient merely to select the head waters, or even the shallow natural resorts of such fish as the young of the salmon, but to plant the product of the hatcheries in waters where the minimum of risk to the young fry can be secured. The sowing or scattering of the fry thinly, over gravelly shallows, will not by any means ensure their safety and there are authorities who favour the planting of large batches of newly-hatched fish in fairly deep water, placing reliance on the instinct of the young in scattering widely, and distributing themselves upon the nearest accessible shallows, in lakes or streams. Young fish certainly do scatter and dissipate in the most amazing manner when planted. They melt away, as it were, before the eyes of the hatchery officers, and close examination a few hours later will reveal to a trained eye the minute, almost invisible, little creatures hiding in interstices between pebbles and boulders, safe from the detection of wandering enemies.

The principal risks to which young fish are exposed, when planted on shallow flats in-shore, as usually recommended, may be summarized as follows :—

(1). Floods and freshets may smother them or sweep them over swampy overflowed fields where they may be stranded and lost. In the deeper main streams this will be less likely to happen.

(2). Frost and floating ice may kill them, as they lie in the gravelly shallows.

(3). Ducks and aquatic animals, especially water beetles, and insect larvæ, which are most destructive to small helpless fish, can detect and prey upon them, when only partially hidden along the sides of lakes or streams.

(4). In dry seasons the fry may be left exposed to drought, or may be cut off altogether from the safety of the main river channel. I have twice during the past summer found schools of valuable fish, of small size, thus cut off and doomed to perish as the water receded. With a small-meshed landing net I cleaned the pools of the imprisoned fish, and carried them to the main channel where they were secure from the fate which otherwise would inevitably have come upon them. In one of these cases the pool, which was almost entirely dried up, contained the young of not fewer than nine species of fish, some of them in considerable numbers, like the small black bass, and doré or pickerel.

The details of the work accomplished in the various hatcheries will be found, as usual, in the several reports of the officers in charge. The report of the Superintendent of Fish-Culture (Mr. F. H. Cunningham), which follows my present report, affords information, summarized, of the hatching ponds, and other fish-propagation methods, in addition to a concise statement of the work of the hatcheries since the report of last season

I have the honour to be,

Your obedient servant,

EDWARD E. PRINCE,

Commissioner of Fisheries and General Inspector of Fisheries for Canada

ANNEX A.

OTTAWA, October 30, 1906.

To Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—Owing to the general success which has attended the operations at the various fish-breeding establishments under the direct control of this department throughout the Dominion, it affords me great pleasure to offer this report on fish-culture for the past year.

One of the most valuable assets of the Dominion is its fisheries, which last year amounted to over twenty-nine millions of dollars, such vast resources forming a national food supply must be husbanded and nature assisted as far as possible by a careful extension of fish breeding operations at such points that offer the necessary facilities for extending the same.

HATCHERY SITES.

The selection of a suitable site is the initial and most important factor of the work. Not only must a supply or pure water be available at all times, but the spawning grounds should be within a reasonable distance of the location. Whilst this remark refers generally, it is perhaps more applicable to British Columbia where it is found that the Pacific salmon will not survive in confinement to the same extent as the Atlantic salmon, hence it becomes necessary that the locations for hatcheries on the Pacific coast must be even nearer the spawning grounds than is actually necessary in the east, which means the erection of hatcheries far up the streams and as very often happens in isolated places, hard to reach and expensive to maintain. The question arises, why not locate the hatcheries in more convenient places and transport the eggs and fry to and from such points. This could be done providing navigation would allow; but unfortunately for the system in British Columbia the streams are so rapid that the reaching of even the spawning beds nearest the mouths of the rivers would be a very expensive and hazardous undertaking.

Again, the sockeye salmon, with few exceptions, are not ripe for spawning purposes until they reach the upper waters of the rivers, which, as a rule would mean the transporting of green eggs long distances by water and over rough trails before reaching the hatchery. This would of necessity entail a heavy mortality in the eggs, so that the inconvenience, isolation and extra cost of maintenance is more than balanced by the larger number of fry that can be produced from a given quantity of eggs by having the establishment near the spawning and distributing point.

RETAINING PONDS.

The system followed by the department some years ago in securing parent salmon for eastern hatcheries was by sweeping the upper reaches of the rivers at about the spawning time. This method was discontinued and a retaining pond established by the late Superintendent of Fish Culture, Mr. S. Wilmot, in the harbour of St. John. From this pond, which would accommodate about fifteen hundred salmon from May to November, it was intended to fill as many of the lower province hatcheries as possible. This scheme has proved very successful.

The parent fish are purchased directly from the commercial catch, placed in the pond and after being spawned are released to return to the salt-water. A number of the fish so retained were marked before being released each year and during the past season a number of these fish have been again captured.

Owing to sewerage pollution it became necessary to select a new site for the retaining pond this season, and as an experiment Little River is being used for this purpose. The ultimate success of the selection can only be determined after the spawning operations are completed this fall.

The question of establishing retaining ponds for parent fish at such of the hatcheries as afford the necessary facilities has been laid before the department on several occasions; but the convenience of travelling in all directions, both by rail and water, from St. John, enables the one general pond to, as a rule, supply the requirements of the eastern hatcheries.

REARING PONDS.

This is a phase of fish culture that might well be extended to such points which afford the necessary facilities, in fact some ingenuity on the part of the officers in charge would make this possible on a small scale at the most of the hatcheries, especially where the waters do not reach too high a temperature. While it would be too costly to attempt this work on a large scale, it might be stated that at Restigouche, N.B., a fair-sized pond for the retaining of salmon until they are four months old has proved very successful, and at Newcastle and Ottawa, Ontario, it is also being done on a smaller but very successful basis.

COLLECTION OF OVA.

This is a matter that requires the most careful and untiring efforts of all the officers connected with the Fish Cultural work in the Dominion. On the efficient performance of this most important detail hinges the success or failure of a season's operations. The greatest care and attention must be given to the proper impregnation of the egg, as it is this first step that makes or mars the operations. It is reasonable to attribute even the comparative small percentage of loss at the Dominion hatcheries to the too hasty performance of this detail, and the necessity for the greatest of care in attending to the proper impregnation of the egg cannot be too strongly impressed upon the officers having charge of this work.

Whilst the object desired by all is to fill the respective institutions to their full capacity, still this should not be accomplished at the sacrifice of a large number of eggs which will most assuredly result if the eggs have not been properly fertilized. While on this question and coupled with the numerous public demands for the establishment of additional hatcheries the serious question of spawning beds arises. Where is the large supply of eggs required for hatchery purposes to be secured? This is a phase of the question that does not enter the public mind, but it is a great source of concern to the officers of the department.

There are salmon and salmon trout hatcheries throughout the Dominion to be provided for and when considering the question, it will be easily understood why anxious moments are often experienced by the officers connected with this service. The time has arrived when attention must be given to the providing of a departmental lake for the retention of salmon trout from which the department can always rely for securing a full supply of eggs of this species. To accomplish this a suitable lake should be selected, cleaned of all other predaceous species and stocked with salmon trout. This will cost money, but resources showing a value of twenty-nine millions of dollars annually are worthy of being fostered.

DISTRIBUTING FRY.

In my report of last year, reference was made to the stocking of lakes by localities instead of planting small quantities of fry over widely scattered areas. This suggestion

has been followed to a small extent, but the system of 'Applications for Fry' makes it difficult to carry out as fully as could be wished; but it is again strongly recommended that this system of distributing be extended as occasion offers.

Reference must be made to the impossibility of supplying applications for speckled trout fry. It is not possible to secure eggs from this species in large quantities, and the planting of these fry should be limited to only such public waters as have been entirely depleted.

ONTARIO.

Newcastle Hatchery.

Theoperations at this premier hatchery of the Dominion have again been successful. These are confined to the hatching of salmon trout, the eggs being secured in Colpoy's bay, Georgian bay. A small bass pond is also operated in connection with this institution. The rearing of fingerling salmon trout on a small scale has also been very successful.

Ottawa Hatchery.

As stated on previous occasions, this hatchery while turning out large quantities of fry is more of an experimental station at which fry of the various species are reared in the aquaria and their habits noted.

Whilst speckled trout have been incubated at this establishment it is not considered advisable to continue hatching this species at this institution, as owing to the high temperature of the water the eggs hatch prematurely, which causes considerable loss. During the past year some eighteen thousand persons visited this establishment.

Sandwich Hatchery.

At this institution whitefish and pickerel are the only species handled. Last year some sixty-three millions of whitefish and twenty-five millions of pickerel were distributed from this establishment.

Bass Ponds, Bay of Quinte.

It appears that the applications for small-mouthed black bass are increasing each year, so much so that it is impossible to commence to fill them all. The hatching of bass in artifical ponds has proved successful, and the work might well be extended at such points as offer the necessary facilities, bearing always in mind the danger, if great care is not taken, that these predaceous fish are not introduced into trout lakes, which would mean the extermination of the trout. On this account applications for bass should be inquired into closely as one planting of bass would create loss and endless trouble.

The past year's operations have been very successful and some fine specimens of young bass are now being distributed.

QUEBEC.

Gaspé Hatchery.

This establishment is devoted entirely to the hatching of Atlantic salmon, the eggs being procured from the salmon retaining pond at St. John, N.B. The operations for the past year have been successful and the fry have been distributed in rivers adjacent to the hatchery.

Tadousac Hatchery.

This hatchery has again experienced another successful season and over two millions of salmon fry were distributed. A subsidiary hatchery was last season erected on the

Ste. Marguerite river, which was necessary as a means of stocking this stream. It obviates the necessity of conveying the young fry to a river difficult of access which was in the past a very hazardous undertaking.

Magog Hatchery.

This hatchery was last season largely filled with gray trout eggs, taken in Lake Memphremagog, and salmon trout eggs from Georgian bay. Some speckled trout from the St. Alexis waters were also successfully incubated. Waters of the Eastern Townships are now showing beneficial results from this institution. It might be mentioned that sea salmon planted in Lake Memphremagog have been caught by fly-fishing during the season just closed. In addition to the quantity of fry distributed from this hatchery to the various waters named in the report of the officer in charge, some two hundred and fifty thousand fry were transferred to the rearing ponds at Lake Lester.

St. Alexis Hatchery.

This hatchery is almost entirely devoted to the hatching of speckled and marstoni trout but some sea salmon are also incubated, and those distributed last season appear to be thriving. Great difficulty is experienced in securing the trout eggs, owing to the almost inaccessible location of the hatchery, but in the face of these difficulties the required number were secured last year and a successful season resulted.

Lake Lester Rearing Ponds.

The success attending the establishment of rearing ponds on this lake has surpassed all expectations. Last season some two hundred and fifty thousand fry of the various species were held in the ponds until they averaged from three to four inches in length, when they were distributed. At the present time some two hundred and fifty thousand fry are doing remarkably well. The success of these rearing ponds may safely be attributed to the ample supply of spring water and the careful attention paid to the fry by the officer in charge.

Lac Tremblant Hatchery.

On Lac Tremblant a small hatchery for the stocking of this and adjacent waters has been in operation for the past two years. Salmon trout with a small proportion of speckled trout are the principal species handled. The operations last season were successful, and this season an effort will be made to secure some trout fry from local waters.

NOVA SCOTIA.

Bedford Hatchery.

This establishment is supplied with salmon eggs from the retaining pond at St. John, N.B. A few speckled trout eggs have been incubated, but it is advisable that the work at this hatchery should be almost entirely in the direction of assistance to the salmon fisheries. Very gratifying reports have been received from different points in the province on the splendid results accruing from the stocking of rivers from this hatchery.

Margaree Hatchery.

Last season's operations at this hatchery were very successful and the salmon rivers in which fry have been planted are said to already be showing the beneficial results of establishing this institution. Over nine hundred thousand healthy salmon were last season distributed in Margaree, Little, Middle and Baddock rivers. The eggs for this establishment are provided from the St. John Pond and, notwithstanding

the fact that the Margaree hatchery is a difficult point to reach with green eggs, the results show that with care in packing and handling the eggs the percentage of loss is no greater than at other hatcheries.

Windsor Hatchery.

Last season was the initial one at this institution and the expectations for successful operations, as mentioned in my last report, have been realized and five hundred and seventy-five thousand salmon fry were planted in the waters of Hants, King's and Colchester counties. At this establishment a small plant for the hatching of shad was installed. The task of securing the shad eggs was entrusted to one of the most efficient officers in the service, but owing to the extremely delicate formation of the shad egg, transportation and the high temperature of the water available, the experiment was not as successful as could be wished. The eggs hatched and premature fish were the result. The eggs were secured in the Nictaux river and another season it will be necessary to erect a temporary structure for hatching these fish at the point at which they are secured. The delicate fibre of the egg will not stand transportation. This is the first time that the hatching of shad eggs has been attempted in Canada and whilst the results were not successful in the quantity of fish hatched, a great deal of experience was gained which will be of benefit for future operations in this direction.

Lobster Hatcheries.

The institutions in this province for hatching lobsters are located at Bay View and Canso. The past season was not as successful in point of numbers as heretofore, owing to the stormy weather and prevailing high winds, which kept the lobsters off the coast as well as preventing the fishermen from attending regularly to their traps.

NEW BRUNSWICK.

Restigouche Hatchery.

The operations at this establishment during the past season have been most satisfactory. The majority of the salmon eggs are procured from fish captured under departmental supervision whilst they are ascending the Restigouche river, the balance required being supplied from the retaining pond at St. John. The rearing pond in connection with this establishment is most favourably commented upon. At the present time some fifty thousand young salmon hatched last spring are now in this pond and will be distributed later on in the season.

Miramichi Hatchery.

This hatchery has been doing excellent work for many years and the salmon rivers adjacent thereto afford large returns to both the actual fishermen and the angler. This building was erected as far back as 1874, and no large expenditure has been made on repairs since that time. For several years past the department has appreciated the necessity for extensive repairs and alterations at this place, but the needs of other places where no fish breeding operations were conducted were so pressing that such alterations were postponed from year to year, until now repairs are an actual necessity and action in this direction is now engaging the attention of the department. It will be noticed in the report from the Officer in Charge (Mr. Isaac Sheasgreen) that, following the suggestions made in my report of last year on the distribution of fry, more attention has been paid to the main streams, in which quantities of fry have been placed, instead of carrying them long distances in wagons over rough roads to the smaller tributaries. In this way the work of distribution has been accomplished at a largely reduced expenditure and the results should prove just as beneficial.

St. John River Hatchery.

Last year reference was made to the extensive repairs that were imperative at this establishment before another season's work could be commenced. These repairs

are now under way and will be completed before the time arrives for placing the eggs in the troughs this fall. The operations last season were satisfactory, some one million three hundred thousand salmon eggs being distributed from this establishment.

Salmon Pond, Little River.

Reference has already been made to the necessity for abandoning the old site used as a retaining pond in St. John harbour. It is not an easy matter to find a place suitable in all respects for this purpose, and after careful inspection Little river was chosen as offering what appeared to be the most suitable facilities for the location of a pond, and temporary arrangements were made for trial of one year before any permanent work was effected. Whilst answering the purpose it has not proved ideal and another site more affected by the ebb and flow of the tide would be more suited to the purpose. It might be here explained that the fish retained in this pond are purchased direct from the commercial fishermen, who perhaps do not thoroughly appreciate the necessity for the utmost care being taken in handling salmon designed for retention in a comparatively fresh water pond. Any abrasion that may occur will not heal on salmon retained in a comparatively small area of fresh water reaching a high temperature, whilst in a pond affected by the tide to a greater extent than the one here alluded to such abrasions will heal in a fairly short time.

Lobster Hatcheries.

The lobster hatcheries in New Brunswick are located at Shemogue and Shippegan. The same remarks made on the Nova Scotia institutions apply here. The rough weather and high winds prevented the collection of as large a quantity of eggs as was hoped for, but those that were secured were successfully incubated, and the young lobsters were distributed in a healthy condition.

PRINCE EDWARD ISLAND.

Kelly's Pond Hatchery.

The season just closed was the initial one at this institution. The operations resulted in the distribution of seven hundred and twenty thousand salmon. This season efforts will be made to secure some sea trout eggs and arrangements in this direction are now being made

Lobster Hatchery.

The hatchery for this purpose is located at Blockhouse Point, Charlottetown harbour. Similar reports to those received from Nova Scotia and New Brunswick have also come to hand from this institution. Spawn lobsters are reported as being limited in number but such eggs as were procured hatched out in splendid condition, the result being the distribution of forty millions of healthy and thriving young lobsters.

MANITOBA.

The two hatcheries for the incubation of whitefish located on Lake Winnipeg were not in operation last season, the cause being such an early closing of navigation on this lake, that it was impossible to convey the eggs to the hatchery. Full reports from the officers having this work in hand were embodied in my last year's report. It is hoped and expected that the coming season will see both of these institutions running to their full capacity.

BRITISH COLUMBIA.

In my report of last year, reference was made to the fact that a competent officer had been placed in charge of each one of the hatcheries in this province, who is held responsible directly to the department at Ottawa instead of to the Inspectors of Fisheries. This change in the system is working well and the service is as easily and as efficiently operated as in the eastern provinces.

Harrison Lake Hatchery.

This is the largest and best equipped institution in Canada, and thirty millions of eggs can be handled each season if it is possible to secure them. Last season twenty-eight million seven hundred thousand young salmon were released from this establishment. The work of capturing parent fish for the current season's operations is now under way.

Rivers Inlet Hatchery.

Last year, the opening season operations were successfully conducted at this hatchery by Mr. Wm. Roxburgh, the officer in charge. Great difficulties were encountered, but a successful distribution of eight millions of salmon fry is the gratifying result of the season's work.

Skeena River Hatchery.

This hatchery has been in operation since 1894 and has been most successful. Last season nearly four million young salmon were distributed. This establishment is difficult of access and is in a very isolated part of the province.

Granite Creek Hatchery.

This hatchery can always be relied upon for a big output of fry in the years of a big run of salmon. The operations are generally successful and last season was no exception to the rule, nearly eleven millions of young salmon being distributed.

Fraser River Hatchery.

This establishment has been in operation for nearly twenty years and during that time has been of great benefit to the salmon fisheries of British Columbia. Since the incumbency of the present officer-in-charge, Mr. J. A. Johnson, small rearing ponds have been provided and other improvements carried out. Last season a quantity of the surplus eggs from the Pemberton and Granite Creek hatcheries were transferred to this establishment, and over nine millions of fry were distributed from this hatchery during the season just closed.

Nimpkish Hatchery.

A report on the operations at this establishment which is owned and operated by the Alert Bay Canning Co. B. C. Packer's Association, will be found with the annual reports from the officers-in-charge of the Dominion Government fish hatcheries which follow this report. Nearly five millions of fry were successfully distributed last season.

GENERAL REMARKS.

The growth of the fish-breeding service throughout the Dominion during the past few years has been large. Since 1903, thirteen new hatcheries have been put in operation, making a total of thirty-two institutions used for this purpose at the various points. The superintendence of this service involves an immense amount of clerical and inspection work, especially at new hatcheries where the officer-in-charge is inexperienced and has to be instructed in every detail. The conditions existing at the various points where these establishments are located vary so much, that instructions suited to each place must be prepared. Many and varied details and contingencies must be provided for and a wrong move at any time places the whole season's operations in jeopardy. To meet this large increase in the work, Mr. Alex. Finlayson, an officer of long and varied experience, both in Scotland and in the fish-breeding service of this country, was chosen and appointed to the position of Dominion Inspector of fish hatcheries. The duties of his office are to inspect the various establishments, instruct new appointees and report on the management of each establishment generally. All the officers connected with this service have taken great interest in their work and can be given a large share of credit for the success attending the past season's operations.

I am, sir, your obedient servant,

F. H. CUNNINGHAM,
Dominion Superintendent of Fish Culture.

ANNEX B.

REPORTS OF ALL THE HATCHERY OFFICERS.

1. BON ACCORD HATCHERY.

NEW WESTMINSTER, B. C., October 2, 1906.

Professor E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—The past year at the Bon Accord hatchery has been very satisfactory and the hatchery had a very successful year.

In July, 1905, fences were put on the streams at the head of Pitt lake, but the freshets were too much for these strongly-built structures and washed the entire capturing plant out. Before the freshets abated sufficiently to allow the rebuilding of the fences, the fish had passed and reached the higher reaches of the rivers. One hundred thousand sockeye eggs were taken in Upper Pitt.

This necessitated looking to other grounds for the supply of spawn, and Granite Creek hatchery was drawn on for 3,000,000 eggs and Pemberton Meadows hatchery for 4,500,000 eggs. The Bon Accord hatchery staff secured 2,000,000 cohoes in the Nicomekl and Serpentine waters, 100,000 in the Hatchery creek, 1,500 trout in the Hatchery creek, and 5,000 steelheads in Stave river; the last mentioned are still in the hatchery but are now hatched out.

The loss was very small, the majority of the fish being particularly healthy.

On January 31, the first distribution of the fish commenced when 3,560,000 fry were placed in the Upper Pitt river, and other shipments followed closely, Lillooet river, 1,500,000; Silver creek, sockeyes, 1,000,000, cohoes, 500,000; Coquitlam river, sockeyes, 750,000, cohoes, 1,250,000; Cowichan lake, 80,000; Sauch-en-auch creek, 60,000; Serpentine creek, sockeys, 60,000, cohoes, 60,000; Squamish, 60,000.

An experiment was made in the planting of salmon fry on the west coast of Vancouver island, and the fish were taken from Bon Accord hatchery to make the experiment. Two hundred and fifty thousand small fish were distributed among Anderson, Sprott and Kennedy lakes on the west coast of Vancouver island, and twelve hundred trout were placed in Price lake near Victoria.

The planting of the sockeye fry on the west coast of Vancouver island, although a new feature in fish culture here was a very successful experiment, as all the fish although subjected to the roughest weather, were in a most healthy condition when liberated.

The prospects for the coming year are very bright and there is little doubt that the hatchery will have its capacity of eggs.

I am, sir,

Your obedient servant,

J. A. JOHNSON,

Officer-in-Charge, Bon Accord Fish Hatchery.

2. HARRISON LAKE HATCHERY.

HARRISON HOT SPRINGS, B.C., August 24, 1906.

E. E. PRINCE, Esq.,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit my report from this hatchery, for the present year. My last report, dated November 16, 1905, showed a total collection at that date of 31,160,000 salmon ova. We afterwards secured additional eggs, making the total 31,274,000, consisting of :

28,204,000	Sockeye salmon
2,510,000	Cohoe "
560,000	Spring "
31,274,000	

of these 2,501,000, or nearly 8 per cent were picked out as unfertile or dead. The eggs and young fry did remarkably well, and the following distribution was made during March and April without loss, the fish going out in splendid condition

To Morris creek	16,000,000
" Silver "	2,500,000
" Trout " and bay	10,272,000
Total distribution	28,773,000

Three ponds were made during the winter, to accommodate some of the fry, and have proved a great help. They cover an area of about 50 by 350 ft. and are supplied with water from the hatchery waste flume. All the fry that were put out at the hatchery, were allowed to work their way through these three ponds becoming thus, in a measure accustomed to outside conditions, while still protected from their enemies. For the collection of ova for the present season, in addition to the camps operated last year, it is proposed to put in fences and pens at Twenty Mile creek, where some sockeye salmon are known to run. The fences and pens at Silver creek and at Douglas creek are already in position and a few fish are in the pens at the former station.

The fences, &c., at Morris creek and at other points will be in place early in September and every effort will be made to secure as many eggs as possible, for this being an 'off' year hatchery work is all the more neccesary and should be pushed to the utmost.

Since the distribution of the fry the interior of the hatchery has been given a coat of paint and this has greatly improved its appearance.

The public interest manifested in the hatchery and its operation is quite remarkable. Being located so close to a popular health and pleasure resort, accounts in a great measure for the streams of visitors. This past year we have had between three and four thousand visitors and our register shows names of persons from all over the world. In fact the premises are hardly ever clear of visitors and they call for an increasing amount of attention and it necessitates the building plant and surroundings being kept in a creditable state, and as far as the number of staff and means would permit, I have tried to keep the place at least presentable.

We have been somewhat handicapped in the work here, by the transfer of the more experienced men to the newer hatcheries and having to train new men to the work. This difficulty is increased by the number of collecting stations working at the same time and these points being so widely scattered. However, I am pleased to report that I have been well supported by the staff on the whole, and that some of them have taken a most exceptional interest in the work and have done everything possibe to ensure success.

I am sir, yours obediently,
THOS. ROBINSON.
Officer-in-Charge.

3515.—2½

3. PEMBERTON HATCHERY.

LILLOOET, B.C., May 8, 1906.

Professor PRINCE,
Commissioner of Fisheries,
Department of Marine and Fisheries,
Ottawa.

SIR,—I herewith have the honour to submit my first annual report on Pemberton hatchery to your department. A report on this hatchery would not be complete without an account of its situation and the different ways of conveyance required to reach it.

Pemberton hatchery is situated four miles to the east of the lower extremities of Pemberton meadows, at the junction of Owl creek and the Birkenhead river, four miles above its confluence with the eastern branch of the Lillooet river, which in turn discharges into Lillooet lake. The hatchery lies as near as can be judged one hundred and seventy-five miles in a north-easterly direction from New Westminster, which is the home of the fishing industry in British Columbia. The route, however, one has to travel from there to Pemberton is very circuitous, starting with a railway journey to Agassiz, a stage drive of five miles brings you to Harrison Hot Springs, where the splendid Harrison hatchery, built last year by the Dominion government can be seen four miles up the lake. The next stage of the journey is one of forty-five miles by the Harrison lake to Port Douglas, which is now but a relic of its former days, when this was the route to the Cariboo diggings.

The traveller now has to resort to a more primitive mode of travelling, and by the time he reaches Tenas lake, thirty-five miles from Douglas, he will be heartily glad to exchange his Indian cayuse for a seat in the canoe, if he has not been accustomed to riding. Tenas lake is six miles long and very narrow, being rather a widened part of the Lillooet river than a lake. At its head it narrows down to a swift river again, a mile of which brings one into Lillooet lake. sixteen miles in length. When half the lake has been traversed in a northerly direction it takes an abrupt turn to the west and from here the first view of Pemberton meadows can be had. When the river is high the canoe can be taken six miles up the river to the rancherie, but usually one has to land at the head of the lake and ride the remainder of the way, ten miles, to the hatchery.

The Birkenhead river, on which the hatchery is situated, is considered by competent authorities, to be the best sockeye spawning stream in British Columbia, and is unlike other spawning grounds in the respect that there is said to be a good run even in off years.

After the site and construction of the hatchery had been decided on, the contract for the lumber was let to Duguid & Hurlay, of Lillooet, who deserve credit for the manner in which they surmounted the difficulties incidental to bringing a 23,000 lb. saw-mill outfit, the 36 miles by raft on Seton and Anderson's lakes, and 24 miles of mountain road to Owl creek. They were three weeks on the road coming in and the same going out; the boiler alone weighed 6,000 lb., and they were engaged four months in sawing the 170,000 feet and planing 130,000 feet of lumber of which the buildings were constructed. Mr. Forrester, the building superintendent, started actual construction in May, though previous to that he had a gang of Indians employed clearing the site, making roads and hewing the sills. One could hardly imagine a rougher spot than that on which the hatchery now stands: in addition to the large trees which were sawn for lumber and their stumps blown out, the ground was covered with large boulders brought down by Owl creek in ages past.

The hatchery is a one-story building 40 feet by 150 feet long with 12-foot walls; it has 12-inch cedar foundations, 2-inch by 8-inch joists, 2-inch flooring and 2-inch by 6-inch studding, the roof is built on the truss system, which obviates the need of posts in the centre and consequently gives a clear floor space from wall to wall; the

building is sheathed with shiplap and rustic on the outside and lined with 6-inch V-joint inside ; it is lighted by 27 large windows and 12 3-ft. by 8-ft. skylights, and is roofed with Elalerite fireproof roofing. The exterior is painted cream with white trimmings, and the interior white.

The hatching apparatus is thoroughly up to date in every particular. A head tank, 18 inches by 18 inches runs the entire length of the building, and the hatching troughs, 112 in number, 16 feet long, 16 inches wide and 6 inches deep, built of 2-inch plank are arranged in groups of four, with a fall of 6 inches between the upper and lower pair. Water is supplied to the troughs from the head tank through $1\frac{1}{2}$ plugs. The waste connections are 2 inch diameter and the waste ditches are 6 inches by 6 inches and 6 inches by 16 inches. The troughs, which are painted white outside and lacquered inside, hold six 16-inch by 24-inch baskets each and riffles are provided between each basket.

A floating gauge in the head tank connected to an electric circuit communicating with the boarding house rings an alarm there when the water either rises or falls an inch. This is the first electric tank alarm installed in a British Columbia hatchery. The boarding house, which is painted the same as the hatchery, is a two-story frame building, 16 feet by 24, with an addition containing kitchen, pantry and bath-room. The main building contains dining room, 12 by 16, office 10 by 12 and hall ; upstairs there are four bedrooms. The interior is varnished, and hot and cold water is supplied to a sink and bathroom. A pipe line of 600 feet supplies the water.

There are also a workshop and wood-shed, 14 feet by 20 feet and 12 by 20 feet respectively, sheathed with rustic and painted uniform with the main buildings. The flume for the supply of water to the hatchery leads from a dam situated 400 feet up Owl creek ; it is built of 2-inch by 16-inch, 2-inch by 14-inch and 2-inch by 12-inch 2-inch plank. It is the largest at the intake and is tarred outside and in, half way down it is broken by a 10-inch cedar log settling tank, 10 feet by 30 feet by 5 feet deep. It is at present being roofed over. There is also an emergency flume extending 150 feet further up Owl creek to a dam there in case of accident to the main one.

The work done by Mr. Forrester is creditable both to the department and himself, and his efforts to have the hatchery finished by August 1 were rewarded by the water being turned on for the first time on that date in spite of unforeseen circumstances and difficulties. In the meantime the building of the traps for the taking of the parent fish had been under way for some time. They were located 200 yards above the hatchery on the Birkenhead, at a point where there was a large rock on both sides to protect the banks. The main fence was built on the tripod system. Ten tripods made of 7-inch fir poles were placed at regular intervals across the stream and filled with rock. The height of water—four feet—made the job an arduous one. The large boulders in the bed of the stream which could not be seen, though their effect on the water was plainly visible, contributed to the difficulty. After two weeks' exertion, during which time dry clothes were almost an unknown quality, the tripods were placed in position and the stringers fastened down. The fencing proper consisted of sections 6 feet by 12 feet, made of 1-inch by 4-inch on edge, and bolted together, and had been under construction while the tripods were being placed. They were laid on the stringers with a 2 to 1 slant lying down stream, and had a yard of heavy duck-canvas nailed along the heel of them to prevent the salmon burrowing ; rock was then placed in front, the pens anchored and leads built from the fence to them. There were fifteen pens in use altogether of different sizes, 12 feet by 12 feet, 10 feet by 12, and 6 feet by 12. Two more fences were built after this before the run came, one 100 yards below the first one to keep the salmon from drifting down. When the run was at its height a section of this fence had to be taken out to prevent the fish crowding too much though the space between the fences was 100 ft. by 200 feet with about three feet of water. Another fence was constructed, one and a half miles above the hatchery, as a safeguard against mishap to the lower ones.

The first sockeye arrived on August 15, but not until the 27th did the run fairly get here ; on the morning of that date the pens hardly had 100 fish, but by night it was found necessary to close the leads to the pens to prevent overcrowding. From the 27th

till September 8, the leads were hardly opened, as it was found that the salmon would not stand penning. The first spawning of 100,000 ova was made on September 4, but all the fish were not in a ripe condition ; on the 8th 1,000,000 were taken.

Spawning started in earnest on Monday, the 11th, and by the end of the week 8,500,000 were secured. Mr. Cunningham, superintendent of fish culture, arrived on the 15th and left on the 17th, and inspected the spawning operations and hatchery ; he was accompanied by Messrs. Forrester and Finlayson. By the end of the week ending September 23, the total in the hatchery was 21,350,000, 2,500,000 being spawned by four spawners in one day.

At this time twenty men were employed. A freshet on the 21st washed a number of salmon over the lower fence and down the river, where they spawned naturally. Altogether 28 millions of sockeye ova were taken, one and a half millions of them at the mouth of the river by means of a seine. The cohoe run did not come up to expectations, only 600,000 ova being spawned and practically all the fish were taken in traps.

During the run of sockeye the males outnumbered the female fish five to one ; they were only blocking up the pens, so I gave the Indians liberty to take all they wanted. They took over 4,000 from first to last. The Indians, I may say here, have given no cause for complaint so far. The only thing I can say against them is that their charges are extortionate.

As you are aware, Mr. Johnson, officer in charge of the Fraser River hatchery, received two shipments from here ; the first lot of two and a half millions he took out himself ; Messrs. Davis and Martin took down the remainder. A shipment of 4,330,000 also went to the H. L. hatchery in charge of Thos. Graham, of the staff of that hatchery. In consequence of these shipments leaving, there were several empty troughs in the hatchery. To relieve the congestion in some of the baskets which contained 50,000 ova, I am redistributing the remaining eggs over the whole hatchery at the rate of 30,000 to the basket. The main fence is still in the river ; there are a few cohoe lying below waiting for a rise in the river ; they only travel during a freshet.

Since October 1, an average of four men a day have been picking the 20,000,000 which the hatchery now contains. We are engaged at present building troughs to hold the surplus fry. I intended building outside ponds, but came to the conclusion that to do so without building a roof over them, for which we had no time, would only be courting disaster considering the snowfall of 3 to 4 feet. The troughs we are building are 12 feet l ng and 2 feet wide, with a partition down the centre which makes two troughs of it. They are placed beneath the hatching troughs on the floor, the waste from which passes along one side through an overflow and back the other side, making a return to the same end that it enters from, but with the partition between. There will be twenty-seven of them built this winter, and if they work well, and I believe they will, twenty-seven more could be placed beneath the upper run and fed from the head tank. They will have one advantage over outside ponds in that they will be easier kept clear of ice and snow, as the hatchery has two heaters in it now.

The experience gained this year will be of great use another season. Though the practice of holding fish in pens works well on the lower spawning grounds, I find that it fails here. Several fences are wanted in the river at the hatchery forming pools where the fish can be held. The upper fence should be high and strong and with pens in connection to spawn out of. About 200 yards down another fence should be thrown across and the first run of salmon allowed to enter and then closed up ; 200 yards farther down the process could be repeated and even a fourth fence put in, if necessary ; by this means the fish would mature even more than was the case this fall, when the fresh run and mature salmon were mixed up between the fences. I also found that large numbers of sockeyes spawn between the hatchery and the mouth of the Birkenhead. The early run of sockeye pushes on to the head waters of the streams they frequent ; the subsequent schools run till they come up with the preceding one, and so on, and the late ones content themselves by spawning on the first bar they encounter. A fence put in during the latter part of the season at the mouth of the river would take a large number of fish that would otherwise never ascend to the upper fences, and the ova taken there could be sent direct to the lower hatcheries.

The first season at a new hatchery is always the worst, as the spawning conditions vary in streams a few miles apart, and a system which works well in one may prove a failure in another. But I would like to say that the staff of seven have done their best to make it a success, and so also has the local help employed.

The result of the season's work at this establishment consisted of a total distribution 17,450,000 of healthy fry.

I have the honour to be, sir,
Your obedient servant.

ALEXANDER ROBERTSON,
Officer in Charge.

4. GRANITE CREEK HATCHERY.

KNALT, B.C., August 22, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit the following report on the operations at this hatchery during the past season. The eggs were collected between August and December and were disposed of as follows:—

Sockeyes from Scotch creek	12,920,000
" Adams river	3,448,000
" Granite creek	1,610,000
	17,978,000
Cohoes from Granite creek	240,000
Total salmon ova	18,218,000

Of those.....3,625,000 eyed.
And..... 875,000 uneyed eggs, were sent away.

4,500,000

1st shipment to Fraser river hatchery—

Uneyed sockeye	875,000
Eyed "	125,000
	1,000,000
2nd shipment to Fraser river hatchery—	
Eyed sockeye	2,000,000
Shipment of eyed sockeye to Harrison hatchery	1,500,000
Total ova shipped	4,500,000
Dead eggs picked out—	
Sockeye	2,804,000
Cohoes	26,000
	2,830,000
Fry liberated	10,888,000
Sockeye	10,674,000
Cohoes	214,000

These fry were released at the hatchery.

The nearest good place, being at the head of the Anesty, or north-east arm of the Great Shuswap lake, a distance of thirty-seven miles from the hatchery.

The upper seven-miles of this arm is ice bound until the end of March, and the spring storms on the lake make the distant distribution of the fry impracticable.

If the fry from Scotch creek ova would return to the Hatchery creek, and make another Morris creek of it, it would be a great advantage; Scotch creek being sixty-five miles distant, and on an Indian reserve, where difficulties with the Indians have to be obviated.

The first sockeye arrived at Scotch creek on August 12.

On the 15th six others put in an appearance.

The first shipment of ova was sent to the hatchery on August 24, and began to hatch on October 25.

On December 10, sockeye were still spawning in the Little river, between the Great and Little Shuswap lakes. Traps were first put in on Granite creek, Scotch creek, and the Anesty river: but the run of fish was so heavy, that at Scotch creek, all available trays were required, and the Anesty fish had to be admitted to the river.

There were two distinct runs, the last was of smaller fish, with pale flesh.

They were very soft, and possibly the paleness of their flesh was due to their ripeness.

Many of this last run reached the Hatchery creek at the extreme end of the Shuswap lake.

Many humpbacks came with the sockeye to Granite creek where they had never been seen before.

This second run made a great rush for Adams river, it being the first stream they encountered on reaching the lake, and a trap was put in the smaller channel; the main channel of Adams river, being a large swift stream, could not be used without great expense.

Great numbers of these fish spawned in Little river, below the Great Shuswap lake, and for miles along the lake shore, at its lower end.

This fall there will be a small late run at Adams river.

The mud in Granite creek is a great annoyance, and last season two men were steadily employed for two months keeping the mud washed out of the troughs.

This deposit of mud was so heavy that in fourteen hours, the ova in the baskets was not visible.

The creek flows between steep banks of clay and fine micaceous silt, and is blocked to its source with limbs and brush, which catch and hold the dead leaves falling into it during the autumn.

This accumulation of dead leaves catches the clay, which heaved by the frost, washes from the banks in the spring.

As these leaves decay and disintegrate, they keep ever coming down, releasing the successive layers of mud.

TROUT.

During May, 1906, 75,000 eggs of the Salmo Kamloops were taken at Skimekin creek.

This creek flows into Skimekin lake, which was stocked with trout fry from ova taken at Canoe and Granite creeks.

The fry this season were liberated in Granite creek; it having become exhausted as a spawning ground of the Salmo Kamloops.

Parties of anglers who visited Skimekin Lake this season secured good catches, many of the fish weighing 6½ to 7 lb.

Your obedient servant,

D. S. MITCHELL.

5. SKEENA RIVER HATCHERY.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit herewith my fourth annual report of work done at the Skeena river hatchery for the season 1905 and 1906.

On July 17, I arrived at the hatchery accompanied by Messrs. A. W. Pretty, J. B. Johnstone and S. Whitwell after ten hours hard poling up the Lakelse river.

On the 22nd, I paid a visit to the spawning grounds at the head of Lakelse lake, which is about eight miles from the hatchery, and found a few sockeyes up there. I then returned to the hatchery and began preparations for getting everything ready to move up to Sockeye river.

On August 1, we left the hatchery for the spawning grounds with some supplies and material for our traps, fences, &c., and by the 9th we had placed in position about 280 feet of fencing, also our traps.

I then returned to the hatchery leaving Messrs. Pretty, Johnstone and S. Whitwell up at the spawning grounds, to get additional stakes, rock, &c., to make the fences secure.

On the 11th, I noticed several spring salmon spawning in Lakelse river and Coldwater creek.

On the 14th, by permission of the department, I engaged Messrs. E. and F. Michaud to do some necessary work at the dam.

On the 19th, Messrs. Pretty and Johnstone came down from the spawning grounds and reported part of our fences washed out, I immediately returned with them taking Messrs. E. and F. Michaud and two Indians with us, and we got them placed in position again and on the same night we trapped several hundred sockeyes; next day we started spawning and got 176,000 eggs, which I took back to the hatchery.

Messrs. Pretty and Johnstone arrived on the 30th with another shipment of 48,000.

I then returned to the spawning grounds and, on September 3, we got 520,000; September 8, 592,000; September 14, 776,000; September 16, 1,016,000, and on September 21, 800,000. Altogether 3,928,000, filling every basket that the hatchery can accommodate. On the latter date we were very fortunate in getting the hatchery full of ova; as it rained very hard for several days causing a big flood which brought large cottonwood and spruce trees down the river, smashing our fences and carrying one pen of fish away entirely, containing several hundreds of ripe sockeyes.

On September 22, we caught two cohoes and noticed a good many in the river.

On October 1, we had another flood; in fact, nothing but floods and freshets since the 5th of August, which hindered us considerably in getting our fences and pens out of the river before the 4th of October, at which date all work at the spawning grounds was finished.

From that date we had heavy rains, and on November 13 we had the worst flood of the season; the water in the Lakelse river and Coldwater creek overflowed the banks and we had two inches of water on the hatchery floor. At one time it began to look serious, so much so that we had the canoe and skiff tied up to the hatchery in case anything should occur.

On November 16, the first fish hatched 88 days after spawning.

On December 1, nine inches of snow fell, only to be followed by heavy rains which lasted until January 9, and on the 21st we had a cold snap the thermometer going down to 12 below zero, from that time fine frosty weather with snow, and on January 24, 47 inches of snow on the level, but from that date until the first week in April we had fine frosty weather with occasional snow falls.

From the middle of January until the young fry were liberated the supply water for the hatchery kept in splendid condition but very cold, for several weeks the water in the tanks registered 32°.

I am very glad to say that the past season has been the most successful season that we have had, notwithstanding all the floods and disadvantages we had to contend with.

I adopted a new plan of picking the eggs all through the hatchery twice a week and turning all of them every day, which I found a great success, doing away with all signs of fungus, so much so that the percentage of bad eggs picked out has been less than 4 per cent.

On April 4, we planted 500,000 young fry in Coldwater creek.

April 17, 1,000,000 on the parent spawning ground at Sockeye river.

April 18, 500,000 in Sockeye river.

April 18, 1,784,450 in Lakelse river and Coldwater creek, making all together 3,784,450 young fry liberated.

April 4, Coldwater creek	500,000
" 17, Sockeye river	1,000,000
" 18 " "	500,000
" 18, Lakelse river and Coldwater creek	1,784,450
Bad eggs picked out	143,550
Number of eggs put in hatchery	3,928,000

On April 19, I left Mr. J. B. Johnstone to take charge of the hatchery and Messrs. Pretty, J. Williams, S. Whitwell and self left in a canoe with Indians for Port Essington, a distance of 75 miles, which we accomplished in 12 hours. We then had to wait three days for a steamer, whence we proceeded to Vancouver and Victoria, where we arrived on the 25th.

In conclusion, I may state that there will have to be another small expenditure at the dam this coming season; in fact, it appears to me that there will have to be a small outlay expended every year after the floods, on account of the low banks and the surrounding country being overflowed.

I remain

Your obedient servant,

THOS. WHITWELL,

Officer in Charge.

6. RIVERS INLET HATCHERY.

RIVERS INLET, September 5, 1906.

Professor E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I beg to lay before you a report on the hatchery built on O-wa-Keeno lake (Rivers Inlet) in 1905. We commenced work on a trail from the head of Rivers Inlet of the Wannuck river, to the head of the rapids on said river a distance of about 3 miles, we then proceeded to the site selected for the hatchery which was so rough with large stumps, rocks and fallen trees it would have taken all summer to clear it; and with so many men on the ground, and carpenters unable to go to work at once, I decid-

ed to go a little closer to the lake shore. I was able to get a contract made with the Indians to carry our lumber from the mill to the hatchery, but we had much difficulty to get them to fulfil the agreement as it is a very rapid running river. We had very favourable weather while the building was in course of construction, but when nearly finished the rain came on, and the water came under and around the building rising nearly to the floor mixing lumber, logs, and roots in dire confusion; luckily the lake did not keep high for any great length of time and we got things in fairly good shape again. The building itself did not suffer badly from the fire which I reported and without any out side help we got it restored and repainted, and the traces of the fire are now scarcely visible.

After the high water of 1905, I set about building a crib around the hatchery which is now well advanced. This was no easy matter as the rock is of such an immense size in the neighbourhood of the hatchery that we had either to blast or bring it a great distance. The creek, which supplies the hatchery is, when high, a perfect torrent and as rocks and huge boulders have been accumulating in its present bed, causing it to overflow and threaten the building (when high) is still dangerous, but we have blasted out and levelled some of the worst places, though much work remains to be done.

It may look as if a blind selection of a site had been made but the sites in the first 20 miles of the lake are all subject to overflow and pretty much alike, and I see no other that excels or equals it in that distance. The lake is never at rest, either rising or falling; if you leave a boat on the beach she is either high and dry or pounding herself to pieces on the shore, and the mountains are so steep that when it rains, (*and it can rain here*) it pours down their sides into the ravines at their base and then up comes lake and river.

We commenced operations for collecting ova on August 20, 1905, putting fences in two creeks which I thought would give us a supply and could fence securely enough to withstand the freshets. By September 20, we had 3,000,000 eggs in the house. It then commenced to rain and washed our fences out. Our fences were very substantially built, and braced every way, and I believe could have withstood the pressure of the water, but when a tree or drift log came down, everything went before it and you have to recommence with most of your picket washed away and unable to be nearer than the mill. We did recommence and on October 20, had our complement of eggs in the house—10,000,000. We did not succeed quite so well as I had wished in rearing the ova. Our feed pipe for water lay on the bed of the creek with sand, small rock and even adult salmon at liberty to enter and choke it up, causing many interruptions and irregularity of the flow of water over the eggs in the house and when frost came the stopping of it altogether. However, we managed to avoid this and came out with an output of 8,000,000. The young fish were distributed on the lake shore in a radius of 2 miles of the hatchery, and amongst great quantities of the naturally raised fry which are there in great numbers in the spring of the year. The Owakeeno lake has a length of 47½ miles, the mountains coming abruptly into the lake with little or no shore for the first 20 miles. Out of every valley comes a creek or river of more or less volume, and the salmon divide and go up all of them, giving no great quantity of fish to any one stream, unless it be the very large ones. Some of these streams are so large we could not begin to fence them with our present methods, and they are so foul with driftwood and obstructions that you cannot use a net. A notable exception to this is the Nimpkish lake 15 miles long. In it there are no salmon streams till you get to the head where three rivers come in, and you have all the salmon in the lake close to your hatchery.

In conclusion I would state that we have to get some of our eggs 24 miles from the hatchery? If it comes a head wind it may be two days before they reach it, and in a crowded row or sail boat you cannot tell what treatment they receive, as the lake is subject to heavy and sudden squalls, and a heavy sea gets up. It would be to the interest of the industry that the department supply a small steamer to carry eggs and perform other useful work, and in these days of steam, electricity, gasoline, &c., I think one could be obtained at a moderate cost.

I have the honour to be, sir,

Your obedient servant,

WM. ROXBURGH,

Officer in Charge R. I. Hatchery.

7. NIMPKISH HATCHERY.

(Owned and operated by the Alert Bay Canning Co. B. C., Packers' Association.)

VANCOUVER, B.C., April 23, 1906.

Professor E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—As per agreement with the Dominion government, we submit the report of operations of our Nimpkish hatchery for season 1905-6.

We stripped our first fish on the 30th day of September, taking 92,000 eggs, and continued taking eggs until the 11th day of October, all baskets then being full. We again started taking spawn on the 18th of October, more baskets having been received; and filled all of them by the 21st October.

We are pleased to state that we took in all 5,037,000 eggs and that we turned out 4,873,400 healthy sockeye fry, showing a loss of a little over 3%, which we consider an excellent showing. Most of the young sockeyes were put into the Nimpkisk lake. The supply of parent fish was ample—we having used only a small part of the supply. Our superintendent reports sockeyes spawning in the creek adjacent to the lake late in December.

The last of the young sockeye were put out on the 18th April.

Eggs received in hatchery	5,037,000
Total loss of eggs picked out	162,000
" " dead fry	1,600
	163,600
Sockeye fry planted in lake	4,873,400
	5,037,000

Respectfully submitted,
B. C. Packers' Association.

WM. H. BARKER,
General Manager.

8. SANDWICH HATCHERY.

SANDWICH ONT., August 22, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit to you my annual report of the operations conducted at the Sandwich hatchery during the past season.

Out of 75,000,000 whitefish eggs which were placed in the hatchery last fall, 63,000,000 young fry were hatched and distributed in the waters named below in a healthy and thriving condition.

Point Edward, Lake Huron	4,000,000
Peach island, Detroit river	2,000,000
Fighting island "	3,000,000
In bay below Fighting island	3,000,000
Stony island, Detroit river	4,000,000
Bois Blanc island "	7,000,000
In lake below Bois Blanc island	5,000,000
Pigeon bay, Lake Erie	4,000,000
Bar Point "	2,000,000
Colchester "	1,000,000
Leamington "	1,000,000
Rondeau "	1,000,000
Port Stanley "	1,000,000
Hamilton, Lake Ontario	1,000,000
Niagara "	1,000,000
Toronto "	1,000,000
Belleville, Bay of Quinte	1,000,000
In river at hatchery	21,000,000
Total	63,000,000

COLLECTING PICKEREL EGGS.

After the distribution of whitefish was completed we again filled up the jars with pickerel (doré) eggs which were collected from the pound-nets in Lake Huron. The number of eggs obtained was 50,000,000 from which were hatched 25,000,000 young fry and disposed of as follows:

Lake Huron	4,000,000
Round lake, Havelock, Ont.	500,000
Belmont lake "	500,000
Trent river "	500,000
Burlington bay, Hamilton, Ont.	500,000
Thames river, Bothwell, Ont.	300,000
Sydenham river, Dawn Mills, Ont	300,000
Detroit river	18,400,000
Total	25,000,000

The above fry were placed in the waters in a first-class condition.

I have the honour to be, sir,
Your obedient servant,

WM. PARKER,
Officer in Charge.

9. NEWCASTLE HATCHERY.

NEWCASTLE, August 21, 1906.

Professor PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit herewith my report on the operation of this hatchery during the past year.

According to instructions I proceeded to Wiarton on the second day of October last, with the usual assistance, to procure the necessary supply of salmon trout ova for this and other hatcheries.

We succeeded in placing our nets for fishing on the 21st of October. We did not succeed in securing any great quantity of eggs until about the 7th of November; it almost seemed at one time that a partial failure was in store for us, but I am happy to state the fish came on later than usual and by the time the season wound up, we had a full supply of ova for this and the other hatcheries.

I handed over to Mr. Walker 1,000,000 for the Ottawa hatchery, also 800,000 for Mount Tremblant on the 15th of November, also 300,000 to Magog hatchery, which left us with about 2,000,000 for the Newcastle hatchery which have done well and which appear in my report as to distribution.

Our hatchery is in fine condition and in good repair, I am now raising a number of yearling salmon trout and am placing two extra tanks at the spring to give them extra room to develop, and will, I consider, be a great advantage to the raising of young salmon trout.

We also have a goodly quantity of young black bass which will number about 2,000, and they, by all appearance, seem to be doing well and ready for distribution this fall.

Our plant at Wiarton is in good condition. Our spile driver will need fresh caulking and the nets overhauled; outside of that, the expense will be nominal.

The following schedule will show the points of distribution, also the number of fry placed in each locality last spring.

Lake Ontario, Consecon	250,000
" Picton Sandbanks	300,000
" Newcastle	200,000
Lake Simcoe, Barrie	200,000
Lake Huron, Southampton	200,000
Georgian bay, Wiarton	200,000
Charleston lake, Athens	150,000
Rideau lakes, Portland	25,000
" Westport	25,000
Total	1,550,000

Two year old Salmon trout.

Charleston lake	300
Bay Quinte, Belleville	200
Total	500

I beg to inform you the fry were all deposited in the different waters in the very best condition.

I have the honour to be, sir,
Your obedient servant,

WM. ARMSTRONG.

10. OTTAWA HATCHERY.

OTTAWA, August 18, 1906.

Profesor E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I beg to submit my annual report of the season's operations carried on at the Ottawa hatchery.

On November 10 last I received from St. John, N.B., through Inspector Finlayson about 125,000 Atlantic salmon eggs.

On November 15 I received from Mr. Wm. Armstrong about 1,000,000 salmon trout eggs.

On March 18 I received from the Magog hatchery about 75,000 gray trout eggs.

On the same date I received from the Bark River hatchery about 50,000 brook trout eggs.

On May 24 I received from the Magog hatchery about 100,000 speckled trout six weeks old.

All the above eggs were received and laid down in the incubating troughs in first-class condition, hatching out strong and healthy in the latter part of May and the first week in June.

The work of distributing the fry was very successfully done by Messrs. A. Halkett, J. B. Rochon, U. Grignon and S. J. Walker.

The young fry were all deposited in the undermentioned waters.

Distribution of Salmon Trout.

Lady lake	21,000
Lake Gregoire	35,000
Grenville lake	21,000
Fairy and Mary lakes	21,000
St. Bernard and Stony lake	28,000
White Stone lake	28,000
Clear lake	28,000
Moscou lake	28,000
Villa Mon Repos	28,000
Mulgrave and Perch lakes	35,000
St. Sixte lake	42,000
Larocque lake	28,000
Miqué lake	28,000
Wilson lake	35,000
Grass lake	35,000
Chelsea lake	14,000
Moose lake	28,000
Maskesty lake	35,000
Beauport lake	28,000
Maheux lake	28,000
Bleu Lea lake	42,000
Pemechongan lake	42,000
Gormon lake	42,000
Sharbot lake	42,000
Ramsay lake	28,000
Meache's lake	42,000
	812,000

In addition to this, on March 21, we shipped 50,000 salmon trout eyed eggs to Alex. Mowat, of the Restigouche hatchery, N.B.

On the same date we also shipped to Alf. Ogden, of the Bedford hatchery, N.S., 50,000 salmon trout eyed eggs, making the total distribution of salmon trout 912,000.

DISTRIBUTION OF GRAY TROUT.

Otty lake	8,000
Bass and Otter lakes	10,000
L'Achigan lake	10,000
Bissonette lake	8,000
St. Esprit lake	8,000
Christie lake	6,000
Lady lake	5,000
Findlay lake	10,000
Chelsea lake	2,000
	67,000

DISTRIBUTION OF ATLANTIC SALMON.

Chelsea lake	10,000
Moose lake	20,000
Charleston lake	40,000
Sharbot lake	20,000
Salmon and Bark lakes	30,000
	120,000

DISTRIBUTION OF BROOK OR SPECKLED TROUT.

Seventh lake	12,000
Ricard lake	12,000
Lady lake	8,000
Plato creek	8,000
Two-mile pond	8,000
Otonabee	8,000
Hudson Heights	8,000
Scotch river	8,000
Big Head river	8,000
Dunn's creek	8,000
Grenville	4,000
Clear lake	8,000
Fairy and Mary lakes	8,000
Ste. Bernard and Stoney lakes	4,000
White Stone lake	4,000
Green lake	4,000
Chelsea lake	4,000
	124,000

RECAPITULATION.

Salmon trout	912,000
Gray trout	67,000
Atlantic salmon	120,000
Brook trout	124,000

Total distribution of fry from the Ottawa hatchery closing the season 1905-06, was 1,223,000.

During the year about (18,000) eighteen thousand persons visited the hatchery.

The hatchery has been repainted and repaired and is now in readiness for next season's operations.

I have the honour to be, sir,
Your obedient servant,

JOHN WALKER,
In charge of Ottawa Hatchery.

11. MAGOG HATCHERY, P.Q.

MAGOG, August 31, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—In submitting my annual report on the operations at this hatchery during the season of 1905-06, I have much pleasure in stating that the several species of fish eggs handled turned out very satisfactorily and the fry were distributed as follows :—

Salmon Trout.

Lake Suivant and Dudswell	15,000
" Noir	40,000
" Stoke	15,000
" Adstock	25,000
" des Poulins	15,000
" Dussault	30,000
" Ste. Modeste	25,000

Speckled Trout.

Lake Weedon	5,000
" Long	10,000
" at Cookshire	20,000
" St. Hubert	10,000
" Tortue	10,000
Rivière du Loup and Cleveland	15,000

Gray Trout.

Lake Megantic	75,000
" Broome	65,000
" Massawippi	60,000
" Memphremagog	100,000
" St. Francis	10,000
" Dennison	25,000
Libbey and Key Ponds	35,000

Atlantic Salmon.

Lake Memphremagog	10,000
" Massawippi	10,000

In addition to the above distribution 250,000 fry were transferred to the rearing ponds at Lake Lester.

The fry were all distributed in splendid condition.

I have the honour to be, sir,
Your obt. servant,

A. L. DESEVE.

12. MONT TREMBLANT HATCHERY.

August 20, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I received, on the 15th November, 1905, 600,000 salmon trout eggs, and, on the 22nd February, 1906, 60,000 red trout eggs.

Of these were distributed : 500,000 salmon trout fry, and 55,000 red trout fry, in the following lakes :—

Lake Tremblant ;
" Boisfranc, near Lake Tremblant ;
" Pimodeau, by Nominingue ;
" Wanish, Noir & Argenté, by Montford ;
" Superieur, Sauvage & Paquette, by St. Faustin ;
" Charlebois and Masson, by Ste-Marguerite ;
" Cornu, by Nantel ;
" Labelle, Clair and Croche, by Labelle ;
" de Sable, at Ste. Agathe ;
" Mercier, near Mont Tremblant.

The fry were distributed in fine condition,

I have the honour to be, sir,
Your obedient servant,

ALPHONSE ROBERT,
Officer in Charge.

13. ST. ALEXIS HATCHERY.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—In accordance with your instructions, I have the honour to submit my annual report on the operations at this hatchery during the past season.

I may say that the work at this hatchery is almost exclusively devoted to the collecting and hatching of speckled trout.

The department is well aware of the difficulties to be contended with in securing large quantities of this species of fish.

However, I am glad to be able to report that (653,000) six hundred and fifty-three thousand eggs were collected and laid down in the troughs in good condition, the first fry appearing about the twentieth of April, and were distributed in the following waters :

Lac Patterson	15,000
" Winchester	50,000
" Vierge	20,000
" Caribou	30,000
" Des Six	38,000
" Corolus	60,000
" St. Jovite	20,000
" La Peche	100,000
" Sans Bout	50,000
" Bonne Terre	20,000
" Bluets	20,000
" Boulanger	50,000
" Three Lakes	20,000
Eyed eggs shipped to other hatcheries	150,000

I may say that all the fry were planted in good condition and the loss during incubation was almost nil.

I have the honour to remain, sir,
Your obedient servant,

JOS. ELLIOTT,
Officer in Charge.

14. BALDWIN'S MILLS REARING PONDS, QUE.

BALDWIN'S MILLS, Aug. 29, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit the following report for the past year.

This establishment has been very successful in the rearing of fish so far, viz., gray salmon and speckled trout, ouananiche and Atlantic salmon and Pacific salmon. The parent brook or speckled trout now in the retaining tanks are looking fine and healthy, and the prospects are that a very much larger percentage of ova than last year will be procured.

From the 230,000 fingerlings on hand last fall, as previously reported, I delivered to Messrs. Deseve and Merry, of the Magog hatchery, which they report as being distributed in first-class condition as follows :—

Gray Trout Fingerlings.

Fall 1905.

Lake Memphremagog	35,000
Lake Massawippi	15,000

Salmon Trout.

Lake Memphremagog	35,000
Lake Massawippi	30,000

Salmon.

Lake Memphremagog	10,000
Lake Massawippi	10,000

Ouananiche.

Lake Croche	9,000

Gray Trout.

Lake Lester (distributed by self)	6,000

Gray Trout.

Spring, 1906.

Lake Lester, per self	21,000

Salmon.

Lake Lester, per self	69,000

Yearlings, Salmon Trout.

June, 1906.
Orford Lake, per Messrs. Deseve and Merry..... 4,000
August, 1906.
Lake Memphremagog, per Messrs. Deseve and Merry..... 4,000
To be distributed as per orders.

Yearlings, Salmon Trout.

Lake Massawippi..... 2,000

I am also pleased to report that I received, June, 1906, in good order from Magog hatchery—

Salmon fry..... 75,000
Gray Trout fry..... 75,000
Salmon Trout fry..... 100,000

The road recently built by the department to this establishment has proved a boon, the distributing of fish, freighting, &c., is accomplished more easily now than by boat, as formerly.

Some 48 tons of ice were put in the ice house last winter. I find a large amount is required for distributing purposes and keeping fresh liver for food.

The fish in the rearing tanks have grown well, with very little loss, though not quite as large this season as last owing to the fact that the winter was long and severe, the hatching being a month later. At present time they are from 2 to $2\frac{1}{2}$ inches in length.

I might also suggest that on account of bad roads the distribution of fish should be no later than the last of September or 1st of October, they will be then 3 to $3\frac{1}{2}$ inches long.

The whole respectfully submitted,
I have the honour to be yours very truly,

W. G. BELKNAP,
Officer in Charge.

15. TADOUSAC HATCHERY.

Tadoussac, August 20th, 1906.

Professor E. E. Prince,
Dominion Commissioner of Fisheries,
Ottawa.

Sir,—In accordance with your instructions, I have the honour to submit my report for the operations carried out in the Tadousac hatchery for the present year. From the crop of salmon eggs of November last, 3,500,000 deposited on the trays in the Tadousac hatchery; 250,000 salmon eggs were packed in moss and sent to the Roberval hatchery to be hatched there and planted this season in the rivers of the Lake St. John. On the first of April last some 500,000 eyed salmon eggs were also packed in moss and sent to our new Ste. Marguerite river hatchery. All precautions were taken to make a success of it. The boxes of salmon eggs have been carried on a sled fitted up with springs to prevent the least knock on the road. Those 500,000 salmon eggs hatched out well in the first days of May and were planted by myself in June in the Portage river tributary of the Ste. Marguerite salmon river. The balance of the salmon eggs

2,750,000 remaining in the Tadousac hatchery hatched out in May, and the salmon fry to the number of 2,435,000 were distributed in the following rivers and lakes :—

Murray Bay river	200,000
Little Saguenay river	100,000
St. John's river	100,000
Jacques-Cartier river	125,000
Ste. Marguerite river, North east B.	200,000
Baude river	500,000
Chisholm river	500,000
Long lake	300,000
Gobeil's lake	300,000
Du Gouffre river by the proprietor, Wm. Kennedy.	10,000
	2,335,000
A Mars river, Ha Ha bay.	100,000
	2,435,000

As usual, we set our two salmon nets in May for the capture of parent salmon. The salmon came in much earlier than usual and in large number. On the 11th of July, we had secured seven hundred fine parent salmon and our salmon nets raised. Of that number 400 were females and 300 males now in the salmon pond and being much admired by a great number of visitors. Besides the 700 parent salmon in the pond waiting for the spawning time, 295 salmon of smaller size were liberated at the door of the salmon fisheries, and 41 damaged salmon were sent to the nuns of the Hospital ' Hotel-Dieu St-Valier, ' Chicoutimi. In all probability, at the spawning time, I will collect at least 4,000,000 eggs. The new Ste. Marguerite river hatchery, situated on a fine stream of the purest water, will prove to be of great benefit for the river and the salmon fisheries in general.

The president of the Ste. Marguerite Salmon Club, Mr. William Mitchell, of New York, went up in July to see the hatchery and was very much pleased with it. The net salmon fishing has been very good. We have been favoured in it by the good easterly wind prevailing in all the fishing season. The fly fishing has also been splendid in all the salmon rivers tributaries of the Saguenay river. The guardians of the salmon rivers report them well stocked with parent salmon. Mr. J. N. Maher, employed by the Provincial Government as guardian of the Saguenay river, told me that he saw enormous quantities of salmon at Ha Ha bay at the entrance of the River à Mars, where some salmon fry from the Tadousac hatchery have been planted every season for the last twenty (20) years. As soon as our salmon nets were taken off, I set my men for the remainder of July to work at some temporary repairs to the dam of the salmon pond, which leaked so much that a small depth of water was remaining in the pond at low tide, and I was afraid for the safety of our parent salmon. On the 3rd of August I had the pleasure of the visit of the Hon. Minister of Marine and Fisheries. The sidewalk leading to the kiosk of the salmon pond, broken by the ice, has been replaced, to the great delight of the visitors. The Lakes Long and Gobeil, with great quantities of fresh water smelts, proves to be a good nursery for our young salmon. About ten days ago a gentleman fishing for trout in the Gobeil's lake caught three fine specimen of young salmon, weighing $2\frac{1}{4}$ and $2\frac{1}{2}$ pounds. The first planting of some salmon fry there had been done in 1902. Those young salmon go down to the St. Lawrence river by the Little Bergeronnes river.

I have the honour to be, sir,

Your obedient servant,

L. N. CATELLIER.

16. GASPÉ HATCHERY.

GASPÉ, September 10, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit my annual report upon the work of the Gaspé hatchery during the past year.

As stated in my last report of December 9, 1905, I laid down in the troughs on November 5, about 1,250,000 eggs, and I am pleased to be able to report that I had a very small percentage of loss.

Owing to the cold late spring, the fry were late in hatching out, and I only commenced planting them in the rivers on July 3, but having a good supply of canoes we got them out quickly and in fine condition, an officer from the hatchery supervising the planting in one of the rivers every day. They were planted as follows:

River St. John (Douglastown)	336,000
River Dartmouth	382,000
River York	382,000
Making a total of	1,100,000

I am pleased to be able to report that both the salmon net and fly fishermen have had a most successful catch this last summer, and the guardians still on the river report great quantities of salmon now on the spawning beds; and amongst them large numbers of grilse and small salmon.

The hatchery is cleaned up and trays, &c., put in good shape for the work for the coming season.

I have the honour to be
Your obedient servant,

R. LINDSAY,
Officer in Charge.

17. RESTIGOUCHE HATCHERY.

FLATLANDS, near CAMPBELLTON, August 22, 1906.

Professor E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to transmit herewith my twenty-sixth annual report upon the operations of the Restigouche hatchery during the past year.

The Government net and W. G. McBeaths licensed net were operated for a short time during the season of 1905, for the capture of parent fish, some 175 very large fish were collected from both nets, and as these were two-thirds female, fully one million fine eggs were collected and deposited in the hatching troughs last autumn. These were further supplemented by a quota of 750,000 eggs from the Carleton pond, St. John, filling the hatchery almost to its usual capacity. Great success was accomplished in

the care and hatching of these eggs, not more than 10 per cent being lost during the period of incubation and after fry had hatched.

The work of distributing the fry in the various streams and rivers began June 20, and they were planted in fine condition as follows:—

Restigouche river between hatchery and mouth Kedgwick, towed by scow	900,000
Upsalquitch river, towed by scow	300,000
Matapedia lake, by train	100,000
Matapedia river "	200,000
Matamaga Salmon Club,	
Causapscal, held over in tanks	25,000
Held over in hatchery in pond and tanks	50,000
Total	1,575,000

Salmon Trout.

50,000 semi-eyed eggs received from Ottawa hatchery in April.	
Fry distributed in Lake Matapedia	45,000
Grand total	1,620,000

The departmental net and W. G. McBeath's licensed net were again set this season about the 1st of June, for the capture of stock fish, both nets were only kept fishing for three weeks, when they were taken up, having captured 340 fine large salmon, the greatest catch in the history of the government net; these fish will yield a very fair supply of eggs for the stocking of the hatchery this fall.

Upon further investigation, I find a great deal of uncertainty existing in connection with the establishment of a salt water pond.

Rather than disturb the present departmental net and pond, it would be better to lease out one or two more of the licensed nets, which are set immediately below the government net, and permit of those fish which are now going into the market being captured for the pond and stocking of the hatchery. Were such a scheme adopted, our net could be raised early in June, when a sufficient supply of fish was obtained, which was the case this season. This method would always guarantee a good supply of fish, at less cost than constructing a new pond.

Since the distribution of the fry, the hatching house has been dried and thoroughly cleansed, and all trays and troughs revarnished and made ready for the reception of the ova this autumn.

Trusting the foregoing report will meet with your approval,

I am, sir,
Your obedient servant,

ALEXANDER MOWAT,
Officer in Charge.

18. GRAND FALLS HATCHERY.

GRAND FALLS, N.B., August 27, 1906.

Prof. EDWARD E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I respectfully request herewith to transmit to you a statement of the work done at the St. John river fish hatchery under my charge, since the month of November 1905. About the 14th of that month I received my quota of salmon eggs from the Carle-

ton pond, about one million six hundred thousands; they arrived at the hatchery in good order in charge of my assistant Frank J. McCluskey, and were placed on the trays immediately on arrival, and they did remarkably well all winter and hatched out a very good percentage of young in the spring, they were carefully handled and kept clean during the hatching season with a good supply of pure cool water all the winter.

On June 18 we commenced to distribute the young fry into the following named waters, with the approximate number in each place:

Ste. Croix river, in Charlotte county	150,000
Tobique river, in Victoria "	250,000
Salmon river " "	245,000
St. John river " "	500,000
Rapide des Femmes " "	150,000
Skiff lake, York county	55,000
	1,350,000

I am very much pleased to be in a position to inform you that the distribution of the fry was well and successfully done.

All of the foregoing is respectfully submitted.

I am, sir,

Your obedient servant,

CHAS. McCLUSKEY,

Officer in Charge.

19. MIRAMICHI HATCHERY.

South Esk, N.B, August 30, 1906.

Prof. E. E. Prince,
Dominion Commissioner of Fisheries,
Ottawa.

Sir,—I beg to submit the following report on the operations at this hatchery during the past year.

By reference to my last annual report, December 7, 1905, it will be seen that the total number of ova collected here last autumn amounted to 2,375,000. Of this number 650,000 were shipped to the hatchery at Windsor, N.S., leaving a balance of 1,725,000 in this hatchery. This number of ova was carried through the winter months without any loss above the usual percentage, and at hatching time yielded 1,650,000 healthy fry, which were distributed in the following waters:

Northwest Miramichi	700,000
Little Southwest Miramichi	500,000
Main " "	200,000
Sevogle river	175,000
Pleasant lake, King's county	50,000
Shediac river, Westmorland county	25,000
Total	1,650,000

It will be seen by the above statement that all the fry were deposited in the Miramichi and Sevogle rivers, with the exception of 75,000 which were applied for by the 'Pleasant Lake Fishing Club' and by 'The Shediac River Fish and Game Club.' It was considered advisable to omit all the small streams in which comparatively small quantities of fry were planted in past years, and to confine operations to the larger and more important rivers. The plan of liberating large quantities of fry in the main streams, it is believed, will prove just as beneficial, and be less costly than carrying small lots to the planting grounds on all the small streams, as has heretofore been done. There are exceptions to this plan where good results can be obtained by planting small lots from year to year. For instance, Pleasant lake in which very few fish of any kind were found a few years ago, now affords splendid angling, resulting from the planting of fry

from this hatchery, but the idea, that in order to benefit the small streams that are tributaries of a large river, that a quantity of fry must be planted in each, as has been done here in the past, is erroneous, and in my opinion these streams will be just as much benefited by planting the fry in the main river into which the smaller rivers empty. As previously stated, this plan was adopted this year, and I may add that all the fry were planted in splendid condition, under the supervision of the assistant officer.

After distribution was completed, the usual work of varnishing the hatching troughs and trays was performed, and the interior of the hatchery put in as good condition as possible.

Although the interior of the hatchery is not in as good condition as it should be, it has been decided not to expend any great amount on repairs this year, but only to have such work done as will insure the coming season's operations to be as successful as heretofore.

The necessity of improving and enlarging this hatchery is great, and I will only state here that although the hatching and distributing of over 1½ millions of fry annually has been successfully accomplished, it has been performed under a great many disadvantages, as the building is old and dilapidated, constantly requiring slight repairs, also badly lighted, and the troughs and tanks not arranged in the manner that experience has taught will give the best results with the least danger of loss. I may also add that the importance of the salmon fishing of this river and bay would justify the erection of a hatchery with fully twice the capacity of the present one. Three millions of fry could be hatched at very little more expense than incurred for the present output. There is no difficulty in obtaining all the parent fish required only a short distance from the hatchery, and the necessary accommodations for retaining them until spawning time can be very easily arranged.

For the purpose of obtaining the required supply of parent fish this year, two stands of nets are now in operation, and although no fish have yet been placed in the rataining pond, the indications are that no difficulty will be experienced in obtaining a full supply.

In conclusion, I may say that another very successful season has been experienced by the fishermen and anglers on the rivers in this section. The catch easily surpasses any that has been made during the last twenty years. Salmon entered the river early in May and continued very plentiful until the fishing season closed. In conversation with one fisherman who operates his nets about twenty miles down river from where the hatchery is situated, he informed me that he procured over 5,000 fish from his own nets in two months. This was not an exceptional case this year, as all the fishermen from Tide Head to the mouth of the bay had catches far above the average. The anglers on all the streams made very large scores and I have been informed by many of these gentlemen that they never before saw such numbers of salmon and grilse in the headquarters of the rivers. Some of the guides say that in many comparatively small pools anywhere from 100 to 200 salmon could be seen. The same is reported from all the rivers. The guides also state that good fishing could be obtained this year on some streams where in past years only on very rare occasions a salmon could be found. Immense numbers of grilse also entered the rivers during the month of July. This will tend to show that the future supply of grown salmon is assured.

On the whole, the salmon fishery was never in better condition, and more profitable to those engaged therein than at present. This is certainly a great encouragement to continue the work of planting as large a number of fry as possible every year, in order to assist nature in keeping up the supply to meet the increasing demands that are annually made upon our fishery. Fish-breeding has become very popular with the fishermen and anglers in this locality, and they appreciate the good done them by the government in operating the hatcheries, and look forward to the time when this establishment will be so improved, that the output of fry will be greatly increased.

I am, sir,

Your obedient servant,

ISAAC SHEASGREEN,

Officer in Charge.

20. SHIPPEGAN HATCHERY.

SHIPPEGAN, August 16, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to report on the operations of this hatchery during the past season. Female lobsters were not as plentiful as last year, which may be attributed to stormy weather which prevailed all through the lobster season. However, the collection of eggs amounted to nearly one hundred millions and the output of young lobsters to seventy millions. The first appearance of young lobsters occurred on the 15th June, and the last distribution was made on the 11th July, when operations ceased for the season. The interior of the building has been cleaned and put in readiness for next year's work.

I have the honour to be, sir,

Your obedient servant,

SEBASTIEN SAVOY,
Officer in Charge.

21. SHEMOGUE LOBSTER HATCHERY.

CAPE BALD, N.B., Sept. 13, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit the fourth annual report of the Shemogue lobster hatchery, and in doing so I am pleased to say that we have been very successful.

The first spawns came in the 31st of May, and we closed on the 28th July, the hatchery being in operations 59 days, with this short season we have put out 122,000,000 of healthy young lobster fry. We delivered these on the usual ground, from Cassey Cape light, west, to Cape Tormentine, east, a distance of about 40 miles; we collected the eggs within these limits.

The lobster factory which I visited made good fishing, of hard shell lobster in June, but much more so in July when the shells got softer, they came in very plentiful, but of smaller size, and it is the general belief that the hatchery has produced 40 per cent of this year's fishing. I have looked after the hatchery business as well as possible, as my report will show.

We have laid wire fence around hatchery lot, also painted the buildings, and pipes, tanks, &c., ready for next season.

I am, sir,

Your obedient servant,

NAP. S. LEBLANC,
Officer in Charge.

22. BEDFORD SALMON HATCHERY.

BEDFORD, N.S., August 29, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I beg to submit my annual report on the operations of the Bedford Salmon hatchery during the past season.

In October last, I procured at Phinneys pond, Spa Spring, Annapolis county, 125,000 speckled trout eggs; and early in November obtained at the Carleton retaining pond, St. John, N.B., about 1,120,000 salmon eggs, all of which were carefully laid down in the hatching troughs here.

At the time the trout were spawned the water in the pond was very low, the fish were far from being lively, and the eggs taken from them were not all perfect, consequently about fifty per cent became sterile.

Of the 1,120,000 salmon eggs, one million fry were successfully hatched and planted in the following rivers :—

Salmon Fry.

80,000	Bear river	Annapolis Co., N.S.
30,000	Milville river	" "
200,000	Pennant "	Halifax "
200,000	Nine Mile river	" "
200,000	Little Salmon river	" "
190,000	Indian "	" "
100,000	Sackville "	" "
Total. 1,000,000.		

The speckled trout were planted in the following named waters :—

Speckled Trout.

5,000	Kidsons lake	Halifax Co., N.S.
5,000	Lochaber "	Antigonish "
5,000	Barren "	Colchester "
5,000	Folleigh "	" "
5 000	Armstrong lake	Hants "
5,000	Fales river	King's "
5,000	Croskills lake	Annapolis "
5,000	Mersey river	" "
5,000	Bear river (East Branch)	" "
3,000	Phinneys Pond	" "
3,000	McGregor's lake	Pictou "
Total.. 51,000		

Salmon Trout (from Ottawa).

10,000	Long lake	King's Co., N.S.
10,000	Aylesford lake	" "

The distribution of fry commenced on the 14th of May and was completed on the 14th of June.

During the past season large quantities of salmon, from the four lb. grilse to the 20lb. mature fish have been captured along the Nova Scotia coast, and quite a number have been taken by fly in rivers where salmon have not been caught for years, and recently stocked from this hatchery.

A number of unsolicited letters have been written me concerning the success of stocking depleted rivers, amongst them are some from Mr. F. B. Gerrard, superintendent of the Commercial Cable Co. Hazel Hill, D. Carmichael, and F. G. Burstal, electricians, all of whom are active sportsmen and take great interest in our fisheries.

These letters, which I herewith inclose, refer particularly to Cole Harbour river, Guysboro county.

Large quantities of salmon, both grilse and mature fish have been playing in the Bedford basin this season, 80 have been caught in nets, and quite a few have taken the fly in Sackville river, and anglers are well pleased with our efforts to restock this river.

The hatchery is in a good state of repair. The usual cleaning, renovating and painting is being performed. The grounds and premises are kept neat and tidy, attracting the attention of all persons who visit Bedford.

I am, sir, your obedient servant,

ALFRED OGDEN.

COOEE COFFRE, GUYSBORO CO., N. S., July 16, 1906.

ALFRED OGDEN, Esq.,
Bedford, Halifax Co., N. S.

DEAR SIR,—You will be pleased to learn the efforts made during the years 1901–2–3–& 4 to restock Cole Harbour river with salmon, the fry being obtained from your hatchery, has proved very satisfactory.

During the past three weeks, anglers report having killed a number of fish in the river, also the fishermen at Cole harbour have been taking them in their nets. They say these fish are somewhat different from the salmon usually caught there. This afternoon, I had the pleasure of landing a beauty from the upper pool in the falls.

As you are no doubt aware, this stream is an excellent breeding ground for sea trout, consequently you will appreciate what a valuable addition has been made to the fisheries of Cole harbour.

Yours respectfully

D. CARMICHAEL.

HAZEL HILL, GUYSBORO CO., Aug. 23, 1906.

ALFRED OGDEN, Esq..
Bedford.

DEAR MR. OGDEN,—I am delighted to tell you that the benefit of stocking the Cole Harbour river with salmon fry has been very clearly demonstrated in the rod fishing results on the upper waters of the stream this season.

Quite a number of salmon have been captured of over three pounds, and many more have been seen,—aye even hooked,—needless to say the latter have invariably been of much larger dimensions than those actually landed.

The members of the Eastern Angling Club, who assisted in the distribution of the fry, are much pleased to find that the efforts to improve the salmon have been so markedly successful. We extend our hearty congratulations to you upon the result, and trust you may find it possible to continue your good work in this direction in the coming spring.

Yours very truly

F. B. GERRARD,
President, Easton Angling Club.

HAZEL HILL, Aug. 23, 1906.

ALFRED OGDEN Esq.,
Superintendent Fish Hatchery.
Halifax, N. S.

DEAR SIR,—It is with a great deal of pleasure that I wish to inform you of the apparent beneficial effects of the department's and your endeavours to improve the rod fishing in our rivers. Several years ago you commenced by sending us some fry for the purpose of stocking the rivers in this section of country and whilst up to the present season I personally have not caught or struck any fish that I could possibly say were the result of such stocking, still I have heard of several who have had such luck.

But this season I was successful in landing three salmon, otherwise grilse, one morning in the river above tidewater at Cole harbour, Guysboro county, weighing six pounds each, and which I am satisfied were the result of the fish sent there by the department and yourself.

I give this testimony in the interest of the stocking and preservation of our river fishing in Nova Scotia.

I think that if work in this direction were continued we should soon have our rivers equal to any on the continent of America.

Yours truly,

F. G BURSTALL.

27. WINDSOR HATCHERY.

WINDSOR, August 23, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—In making my first annual report on the operations conducted at this hatchery during the past season, I am pleased to state that the hatching and distribution of the Atlantic salmon eggs was most successful.

The eggs were received through an officer from the hatchery on the Miramichi river who attends to the placing of the same in the hatching troughs and gave me advice as to their care.

During the season some inconvenience was experienced from sediment but no injury was caused to the eggs. The fry were distributed under the directions of Inspector Finlayson and placed in the following rivers :

Meander, Hants Co	110,000
Avon, "	155,000
Kennetcook, "	50,000
Gaspereaux, King's Co	60,000
Cornwallis, "	50,000
Great Village, Colchester Co	50,000
De Bert, " "	50,000
Folley, " "	50,000
Total	575,000

An experiment was made in the hatching of shad, but, notwithstanding the indefatigable efforts of the officers having this work on hand, the high temperature of the water supplying the jars in which the eggs were placed caused a premature hatch, the young fish being too weak to rise in the incubating jars. Respectfully submitted.

I am, sir, your obedient servant,

FRANK BURGESS.

24. MARGAREE HATCHERY.

N. E. MARGAREE, N.S., August 29, 1906

Professor EDWARD E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—In compliance with recent instructions I herewith submit the annual report of the fish-cultural operations conducted in Margaree hatchery during the season of 1905–06.

On October 26, 1905, I proceeded to Carleton retaining pond, St. John, N.B., to procure the necessary quantity of salmon ova for the season's operation. On November 8, I arrived at the hatchery with 1,072,000 fertilized ova, which were without delay removed from the transportation cases and placed in the incubation troughs. Having abundance of space, and for reasons best known to the pisciculturist, a lesser number of ova were carried on each tray than past years. We were troubled less with *fungus*. This fact and better general results is attributed in part to that. The average daily temperature of the water was higher than usual, consequently hatching commenced earlier, and were concluded about April 15. The resultant fry, vigorous and healthy, numbering 910,000, were planted during May and June in the following rivers and streams, namely :—

DISTRIBUTION OF FRY.

Stewart's brook, Margaree river, Inverness Co.	25,000
Big Intervale " "	75,000
Sugar Loaf " "	50,000
Black Rock " "	25,000
Tingley " "	50,000
Greig's " "	100,000
Hatchery " "	50,000
Hatchery brook " "	50,000
N. E. Margaree " "	100,000
Cranton's Ferry " "	50,000
Phillips' " "	50,000
Rossville " "	75,000
Cheticamp, Little river "	150,000
Middle river, Victoria Co.	30,000
Baddeck " "	30,000
	910,000

It will be noticed that fewer rivers were stocked this season. This is following the suggestion made by the Superintendent of Fish Culture, in his last annual report, where he recommends the discarding of the system of stocking indiscriminately and inaugurating the system of stocking by localities. The Margaree and Cheticamp, the leading and most important salmon rivers of Cape Breton island, mainly received the output of the hatchery. It is hoped during succeeding years to stock other streams in a similar manner. I am convinced that the very best results will follow this system of stocking.

I am pleased to be once more in a position to report the good work being done by this hatchery. At the inception of the artificial propagation of salmon here, in 1902,

and since, very strong opposition was offered to the work. We were informed that we would never see any good results. But last year the first results were visible. For twenty years salmon were never more plentiful. The majority were convinced. A few would not yield but maintained that last year's results were accidental, and would not be continuous. But the last is simply eclipsed by the present season, which is truly a 'record breaker.' Since the opening of the season it is no exaggeration to report that the Margaree pools are teeming with fish, if perchance the angler has not had success, the fault lies generally with himself. Large numbers of sportsmen have fished its pools with wonderful success, among the number several celebrities, led by William Travers Jerome, New York's District Attorney.

At present I am having the buildings renovated, the supply tank, troughs, trays, and cans varnished, and fixtures placed in readiness for a new supply of ova.

All of which is respectfully submitted.

I have the honour to be, sir,
Your obedient servant,

A. G. CARMICHAEL,
Officer in Charge.

25. BAY-VIEW LOBSTER HATCHERY.

PICTOU, August 23, 1906.

Professor E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I beg leave to submit my report of operations at Bay-View Lobster hatchery for the season of 1906.

I commenced to get the hatchery ready for operation on April 23, one week earlier than last season.

I started the steam pump on May 7, with 7,000,000 of eggs in the jars, and with the aid of a steamer I collected ova from five canneries up to June 19.

Female berried lobsters were very scarce this year, and I was only able to fill 270 jars, or 50 jars short of the capacity of the hatchery.

This season was very cold and stormy and the fishermen missed a good many hauls during the season.

The eggs were delivered to the hatchery in good condition and hatched out very successfully.

The fry appeared first in the tanks on June 20, and hatched out very rapidly. 100,000,000 fry were distributed between Pictou island and the mainland, and around Gull Rock. 18,000,000 were also distributed between Merigomish, Arisaig and Cape George.

The frequent storms this year gave us a lot of work in caring for the eggs, by bringing in a lot of mud which could be remedied by having the supply pipe extended further out into the channel.

During the season, with authority from the department, I had the steam connections and valves renewed on the boiler. I also pointed the outside of the salt water tank, and repaired the curbing of the wells. This season being wet our wells gave us a good supply of water for the boiler.

Last September the entire covering of the wharf was renewed, it is now in good repair, and under ordinary conditions should last for many years.

The galvanized inner waste pipes will have to be renewed before we commence operations next season, but repairs to the hatchery will be very light next year.

The hatchery was closed on July 11, after the necessary cleaning and painting.

I have the honour to be, sir.
Your obedient servant,

W. F. HARRIS.

26. CANSO LOBSTER HATCHERY.

CANSO, N.S., August 30, 1906.

Prof. E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa, Ont.

SIR,—I beg leave to submit my second annual report of operations at the Canso hatchery for the season of 1906.

Having some preliminary work about the inside of hatchery I opened it on April 2nd so as to be ready to receive the ova as soon as fishing began.

On 19th we began operations, but owing to it being such a backward spring there was not much fishing done in April. On 30th the steamer began collecting ova and visited the factories about Tor Bay, White Head, Canso and Queensport.

We collected 95 millions of eggs and had them delivered at the hatchery in good condition.

We hatched 71 millions of healthy, young fry and distributed them around the waters of Tor Bay, White Head, Canso and Queensport.

Fishermen are taking great interest in the hatchery here since seeing its practical working results ; they think it is a grand thing and very much needed to replenish the lobster fishery, which has for the last few years been falling off.

I have the honour to be, sir,
Your obedient servant,
JAMES MEAGHER,
Officer in Charge.

27. FOURCHU LOBSTER POND.

LOUISBURG, C.B., NOVA SCOTIA, September 18, 1906.

Professor E. E. PRINCE.
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I beg to submit my report as the officer appointed to supervise H. E. Baker's seed lobsters pound at Forchu, N.S., for the year 1906.

The first seed lobsters were deposited in the pound on the 14th May.

The lobsters taken in pound from the 14th May to the 30th June, with the exception of about 3,000, were removed and placed in the waters off the Richmond county coast the sixth and seventh days of July. The lobsters were in good condition.

Lobster fry was first seen in the pound on the 18th July, and from then to the date of the final removal fry was seen daily in and around the pound. They do not stay in the vicinity of the pound but can be seen swimming towards the ocean shortly after being hatched. On the third and fourth of August all of the lobsters were replaced in the waters off Cape Breton and Richmond counties, care being taken to replace the quantities of lobsters as nearly as possible in the waters from which they were originally taken. All of the lobsters this season were in exceptionally good order and condition when taken out of the pound.

The death rate was considerably less than in former years. In May and June it did not exceed two per cent, and in July a fraction over three per cent.

The weather during this season has been colder than usual, and the temperature of the water was considerably less than the preceding years, which accounts to some extent for the low death rate. Also, the lobsters were handled more carefully in the fishing smacks while being conveyed from the fishing grounds to the pound.

The condition of lobsters at time of removal was as follows. viz. : Eleven per cent eggs hatched, thirty-five per cent pale, light coloured eggs, advanced, the balance were in different stages of development, principally dark and green coloured, and would not hatch for some weeks. The sizes were from eight to twelve inches, principally from nine to eleven inches. We had a few fully developed lobsters with eggs seven and seven and half inches.

The catch of all kinds of lobsters on this coast has been under the average, the quantity of seed lobsters caught was considerably less than during the previous seasons.

It is too soon for the fishermen to feel the effect of the pound at Fourchu, N.S., by increased catch of lobsters, as it has not been in existence long enough for the young lobsters to grow large enough to be caught. I look for considerably larger captures on this coast in a couple of years as a result of the mother lobsters having been taken care of and allowed to develop their young in a natural way.

Everything I have written in my previous reports in connection with the pound for seed lobsters at Fourchu, N.S., I again confirm.

I am, sir, your obedient servant,

H. C. V. LEVATTE,

Fishery Officer.

28. KELLY'S POND HATCHERY.

KELLY'S POND, P.E.I., June 2, 1906.

Prof. E. E. PRINCE,

Dominion Commissioner of Fisheries,

Ottawa.

SIR,—I have the honour to submit to you my report of last season's work at Kelly's Pond hatchery. On November 9, Inspector Finlayson of the Department of Marine and Fisheries placed in the hatchery 800,000 salmon eggs. For the first two months we were very much troubled with muddy water which necessitated a great amount of washing. However I am happy to say it did not injure the eggs in the least. On February 9 the eggs began to hatch ; on March 24 we emptied the trays into the troughs. At least 90 per cent of the eggs were succesfully hatched out and distributed in the following rivers, viz.:—

Morell	200,000
Winter river	300,000
Wheatley river	100,000
Dunk river	100,000
Mores river	20,000

In the last four mentioned rivers we did not see a single dead fish, but in Morell there were a few that were not as lively as I would like. The hatchery and the dam are in a very good state of repair, but my assistant's house and the hatchery would be very much improved by having another coat of paint.

I have the honour to be, sir,

Your obedient servant,

A. W. HOLROYD,

Officer in Charge.

29. BLOCK HOUSE POINT HATCHERY.

BLOCK HOUSE POINT, P.E.I., July 10, 1906.

Prof. E. E. PRINCE,

Dominion Commissioner of Fisheries, Ottawa.

SIR,—I beg to submit my report of the work done at Block House Point hatchery for the past season. The hatchery opened for work on the 9th day of May. For the first three weeks the weather was very stormy, consequently it was impossible for the tug to make regular trips. The percentage of spawn lobster was unusually small, therefore we did not get as much spawn as last year, but I am pleased to say it hatched out splendidly. We had no dead lobsters or bad spawn in the hatchery. We distributed ninety millions of young lobsters in the following places, viz : Canoe cove, St. Peter's island, Governor's island, Governor reef, Holland cove and at the entrance of Ch Harbour. During the summer there has been a coal shed and sleeping house built for the men.

The hatchery and buildings are in good condition.

I am, sir, Your obedient servant,

A. W. HOLROYD,

Officer in Charge.

ANNEX C.

REPORT ON OYSTER CULTURE BY THE DEPARTMENT'S EXPERT FOR THE SEASON OF

1906.

C. G. S. 'OSTREA' SHEDIAC, N.B., October 1st, 1906.

Professor E. E. PRINCE,
Dominion Commissioner of Fisheries,
Ottawa.

SIR,—I have the honour to submit to you my report on oyster culture of this season's work to date in Prince Edward Island and New Brunswick.

On the 14th May I received instructions from your department for the *Ostrea* to patrol the coast between Cape Tormentine and Chockpish on the New Brunswick shore, to prevent lobster lines and gear being placed in those waters before the 25th May in that district; this was effectually carried out, Fishery Officer James Noonan being on board during the time we were patrolling between Cape Tormentine and Shemogue. On the 25th May returned to Charlottetown, where I coaled, watered and provisioned steamer, but owing to bad weather was unable to leave until the 1st June, when I sailed for Malpeque, P.E.I., arriving there on the 5th instant.

Malpeque.

On my arrival I was met by Fishery Officers Davison and Forbes and spent the remainder of the week with them at Grand river and Bideford river, settling disputes among the quahaug fishermen. In the following week, I commenced raking on the oyster beds in Richmond bay and continued to do so while weather permitted until the 20th July, when I considered it advisable to discontinue my work, as I had been watching the oysters and found they were nearly ready for spawning. Raking over the grounds in the spring months cleanses the beds, by removing seaweeds and eel-grass, it turns over the loose shells and disturbs the sediment, which is carried away by the tides, leaving the beds clean, as on the opening of navigation they are in a dirty state, for they have laid dormant all the winter, covered over with ice and no action of the sea to disturb the bottom until a thick sediment has settled over the whole area; this I know from actual experience. The grounds require to be worked on before the spatting season arrives which does not take place as a rule until late in July as the temperature of the water has not become sufficiently warm until the above date, and it is positively necessary for some such work to be carried on to cleanse the grounds, if one desires the spat to find a favourable resting place. Most of the work was done on a very large bed situated off Little Curtain island, but when it was too windy and rough to remain on that bed, I hauled the rakes over the whole oyster area in the bay, by going up to the head of the bay, thus taking advantage of all the areas I could.

After finishing this work I patrolled the bay with Fishery Officer Forbes on board to see that all lobster gear was taken in. This was done satisfactorily.

I then made an examination of Grand river in which Mr. D. Forbes gave me valuable assistance, when the following areas were laid off for mud digging purposes to the satisfaction of both fishermen and farmers. I have described them as follows, giving the local names and places which are known to all the residents :—

No. 1. The first one in Grand river is on lot 14 side, called the Long mussel bed lying off Thompson's cove, Lot 14, to Kingsland point, Lot 16, reserving the ell on the south side or edge for oyster fishing. This bed is approximately about thirty-five acres in extent with mud varying from 14 to 20 feet deep.

No. 2. McLean's bed on Lot 14 side, lying off John McLean's shore east of the road between the Priest's farm and John McLean's farm. This is a large bed where mud has been dug in the past.

No. 3. This is a large bed on Lot 16 side, off Alec. McNeill's shore, known as the Alec. Kenneth bed.

No. 4. Is a large bed on Lot 14 side known as the Bell or wharf bed close to the old wharf.

No. 5. Is a large mussel bed on Lot 16 side known as the McLaren Point bed lying off McLaren's point.

No. 6, This is a large bed lying just to the westward of Grand river ferry wharfs. This is a hard bed and an obstruction to navigation ; and all the beds lying east of ferry wharfs, three or four in number, the lowest being about two miles below the ferry and a little to the eastward of Big Marsh shoals.

These are all large beds with deep mud, and will last for years, and the above description is sufficient as they are all locally known.

While writing on this subject I might suggest that a more systematic form of mud digging be adopted, as the areas are becoming more limited each year ; by removing the mud from the area clean and even, but as it is now, a man digging for mud strikes out in the longest direction leaving lumps and hummocks all over the bed. If the area were dug out clean, this ground might afterwards be converted into another oyster growing area which would last for ages, now it is only an obstruction to navigation where the cuts fill in with soft mud. This could be followed out if the areas to be dug on were staked by the mud diggers before navigation closes, but at the present time there is an unwritten law among mud diggers, that staking of the ground is not allowed and the first man to cut ice and place his digger in position has the right to the best cut on the bed, but I have no doubt that some arrangement might be made so that the bed once dug on should be entirely removed to a sufficient depth and an even bottom. This finished my work in Richmond bay and on the 2nd August I sailed from Malpeque, arriving at

The Brae

on the 3rd, when I examined the mud digging areas in dispute and and gave the following privileges to the satisfaction of all concerned by striking a line across Brae harbour from Alexander Milligan's west line fence on the north side of Harbour bay, to the inside point of the sandhills on the north-east side of Brae island ; all to the westward of this line to be granted for mud digging purposes. This is practically all the mud available in the harbour ; there are one or two small patches with little depth which have been applied for, for cultivation ; they are utterly worthless to dig on, and will soon be muddied over, unless a little attention is given to them. I sailed from the Brae on the 5th August, arriving in Charlottetown on the 6th inst.

Lobster Patrol.

On my arrival at Charlottetown I found instructions to proceed to Shediac at once, as the clam fishermen were encroaching on the oyster reserve. I patrolled the bay for a few days and was getting ready to rake over the bed here, when I received instructions to proceed to Cape Tormentine and patrol the coast for illegal lobster fishing. On my

arrival I was met by Fishery Officers Copp and Noonan, the latter accompanying the *Ostrea* each day she was out; I succeeded in destroying ten back-lines and traps in the vicinity of Cape Tormentine and Baie Verte, also eight lines and traps off Cape Bald; returning to Shediac on the 8th September, the weather being very wild and unsettled during the time I was there.

Shediac, N.B.

On the following week I commenced to rake over the beds in Shediac bay and am still doing so at the time of writing. On examining the Wilbur bed I made three hauls of the dredge with the following results: *1st haul*, 21 large 14 small, *2nd haul*, 35 large 20 small, and *3rd* 58 large and 25 small; I have not yet examined the other beds, but will do so after finishing cleaning this one.

Quahaugs or Hard Shell Clams.

While in Grand river I saw that a great deal of harm had been done to the oyster beds by the quahaug fishermen, who use the long single toothed rake for this purpose, which should be prohibited on oyster beds, as it comes up full of soft black mud. This is washed off before the clams can be picked out, this causes a thick sediment carried by the tides to settle on the oyster beds, giving the oyster spat no chance whatever of finding a resting place, and the amount of mud disturbed in this way is sufficient to choke the parent oyster. I have always maintained that it was detrimental to the oyster industry to fish clams after the close season for oysters had commenced. And as so much trouble is caused by the clam fishermen working on oyster beds during the oyster close season, I would strongly urge the department to take immediate action in placing a close season on hard shell clam fishing. It is now becoming scarce in some localities, and the sooner action is taken the better it will be for the industry, as it is a valuable one and should be preserved.

Tongs and Rakes.

For a number of years the tongs with teeth not more than three inches in length have been used with great success in Prince Edward Island and do not injure the beds, the single-toothed rake with teeth nearly a foot long break the crust of the oyster beds causing mud and sediment to find a resting place which is very detrimental to the beds. The single-handled rake and mechanical tongs or grapnels, (an American invention) hoisted to the surface of the water with a winch, should be prohibited by law from being used on our oyster beds.

Transplanting small Oysters.

During some seasons the oyster spat fall more heavily than others, and there are several shallow natural resting places where young oysters are found, the spat being carried there by the tides, can be easily picked up, especially around Curtain and Ram islands, Richmond bay. If arrangements could be made for these small oysters to be picked up in the spring of the year and transplanted to some of the natural oyster beds lying in deeper water, it would be a great advantage to this fishery in general, as these small oysters do not mature as a rule, but are killed by the frost and ice during the second winter if not removed and placed on areas by other persons. Large quantities have been picked up from time to time by individuals and laid on private areas, but that is of no material advantage to the general public, and if some system like the above could be arranged it would certainly be an advantage to all concerned in the industry.

I have the honour to be, sir,
Your obedient servant,

ERNEST KEMP,
Oyster Expert.

EXTRACTS FROM A PAPER ON OYSTER CULTURE, READ AT THE BOARD OF TRADE ROOMS, CHARLOTTETOWN, ON 23RD MARCH, 1906, BY CAPTAIN ERNEST KEMP, DOMINION OYSTER EXPERT.

Oyster culture is a subject which covers a great deal of ground, as it is conducted in so many various ways according to the country and locality in which it is prosecuted. A general idea of these different systems will not be out of place if I briefly mention some of the methods in which it is carried on abroad before making any suggestions, as to what should be done in the maritime provinces. We all know the waters around us are admirably adapted for the cultivation of these delicious bivalves, as they are growing naturally from the Bay des Chaleurs, along the New Brunswick and Nova Scotia shores, rivers and bays, as far as the entrance of the Strait of Canso, in the waters of Cape Breton, and last but not least, all the waters of Prince Edward Island ; how much more so, would be, the output of this extent of territory if all the available water space were occupied by private culturists, it is not for me to say.

I would like to convey to the mind of the culturist, certain things to be carried out and others to be avoided, in order to make his labours a success, so will first make a few remarks on

Oyster Culture in England.

I was brought up among oysters and my intimate connection with the Whitstable Oyster Company, of which I am still a member and where I gained most of my practical knowledge and experience, will enable me to bring to your notice a few facts connected with the industry.

No artificial means are used by the above company on account of the exposed situation of the beds, being nearly four miles off shore. The system of dredging with sailboats is carried on to catch the supply for market, and clean the grounds by moving the cultch or loose shells, and removing weed, starfish, dogwhelks or borers as they are called here, or any other marine enemy of the oyster, also to transfer oysters from one bed to another ; the constant dredging keeps the shells in a clean condition, and periodically shells are scattered over the beds to catch the spat. The area is about one and one-half square miles in extent and is divided into sections or beds, different grades of oysters being placed in each particular section, there is one place for marketable oysters, another for half-grown, another for the small, and so on. The fishermen are informed of the quantity and quality they are to catch, each day they go to work on the grounds. These oysters are taken to the company's warehouse where they are culled and shipped to all parts of England and the European continent, as they may be ordered ; no oysters are sold on commission for what they will realize. The price is fixed by the company, and very little change is made after it is once fixed for the season.

The oysters sent to market are all of an uniform size, whether it is large or small, according to the grade or quality.

Very little, if any poaching is carried on by the outside fishermen in English waters. At one time some of the ordinary fishermen were strongly opposed to the scheme, where companies applied for concessions, but after these companies became established in many cases it was found to be of great benefit to them, as it opened up a ready market for their catch of oysters, whether young or old, and often they would find employment by hiring themselves and their boats to the oyster growers, where their time would be taken up in cleaning and cultivating the grounds, also catching oysters for market when the trade was brisk, so that the apparent loss of a small area of ground which was entirely useless to them, but where they would occasionally try to fish eventually became a source of employment to many of them with regular wages.

Should any poachers be caught in the act, they are severely dealt with at the hands of justice, either by paying heavy fines or imprisonment. To prevent raids being made by poachers on these valuable grounds a staff of watchmen are always on hand for both day and night work. Dogs are often trained on these watch boats to bark as soon as a boat or vessel comes within the limits of the grounds or is sailing by. These means all tend to keep marauders at bay. Creeps or grapnels are sometimes used ; they

are attached to chains and spread over the areas, which would catch a dredge if it were hauled over them. Prevention is better than cure. * * * * *

In France the method is somewhat different, as the weather is so much milder and frost is not sufficiently felt to hurt their undertakings, and it is entirely artificial, tiles are used dipped in a solution of sand and lime, forming a rough coating of cement for the oyster spat to adhere to, they are then arranged in layers or in tiers laid crossways, these tiles are not flat but long and rounded, so formed that the spat might adhere to both sides of it.

After the spatting season is over they are carefully inspected, and if the spat had adhered, the tiles were sometimes placed in deeper water until the following spring, when the young oysters are stripped off, by means of a knife or chisel made for the purpose. They are then placed in trays for a short time and afterwards deposited in clairs, pits or other areas allotted for them. Of course this method is impossible in this country owing to the severity of the winters, but I thought it would be useful to know how it is done.

The clairs, which are used chiefly for fattening and greening purposes (of which the French are so fond), are diluted with a little fresh water, and are kept more stagnant than the ponds which are used for growing purposes. Parc owners affirm that the smaller the quantity of water there is in a clair, the oysters, being more exposed to action of light and heat, consequently grow with greater rapidity.

In the parc at St. Joseph's in France, which are most exposed to the inclemency of the weather, the oysters are turned, and laid on their flat sides. This ingenious arrangement renders the animal less accessible to the action of the cold, and gives the shell a firmer position, thus preventing it from being too easily lifted by the surf, and from being thrown to a distance by the violence of the sea.

Oyster Culture in the United States.

Oysters are to be found on nearly the whole length of the coast line, in some places more plentifully than others. There is such a vast area of water suitable to the natural conditions of the oyster and the demand being so great the grounds are divided into two parts, one being the public or natural bed of the State, and the other consists of areas of ground brought into cultivation by owners and companies who devote their time and spend large sums of money in order to bring these grounds into a high state of cultivation. After that is done, the first expense being the heaviest, the grounds are kept clean, and oysters are obtained for market at the same time. Oysters are considered so cheap and plentiful that they are eaten by all classes ; they are also exported in large quantities to the European market and also to the Pacific coast for planting purposes.

Oyster farming in America, which presents some features of resemblance to the French system, and also many differences, has grown up as the result of private enterprise, without any help or any direct encouragement from the government.

Several years before Coste and De Bon commenced their experiments, the oystermen of East River, having observed that young oysters fastened in great numbers upon shells which were placed on the beds at spawning season, started the practice of shelling the beds in order to increase the supply ; and in 1855, or three years before Coste represented to the French Emperor the importance of similar experiments, the state of New York enacted a law to secure to private farmers the fruits of their labour, and a number of persons engaged in the new industry on an extensive scale.

In portions of Long Island Sound, especially off New Haven, it has been needful to make a crust or artificial surface upon the mud before laying down the shells. This is done with sand.

The following account of the method of laying out and stocking a deep-water oyster farm in Connecticut, and the statement of the attendant expenses, is copied from Ingersoll's 'Report on the Oyster Industry of the United States' :—

'It is thought hardly worth trying unless at least fifty acres are obtained, and many of the oyster farmers have more than one hundred acres. These large tracts,

however, are not always in one piece, though the effort is to get as much together as possible. He obtains the position of the ground, as near as he can, by ranges on the neighbouring shores, as described in his leases, and places buoys to mark his boundaries. Then he places other buoys within, so as to divide his property up into squares, an acre or so in size. In this way he knows where he is as he proceeds in his labours. Having done this he is ready to begin his active peparations to found an oyster colony.'

Preparations.

'When a cultivator begins the preparation of a deep-water farm, his first act is to scatter over it, in the spring (about May), a quantity of full sized, healthy native oysters, which he calls 'spawners.' The amount of these that he scatters depends on his circumstances; from thirty to fifty bushels to the acre is considered a fair allowance here, I believe. The rule is, one bushel of spawners to ten bushels of cultch. He now waits until early in July (from the 5th to the 15th is considered the most favourable time), when he thinks his spawners must be ready to emit their spat. He then employs all his sloops, and hires extra vessels and men, to take down to the harbour the tons of shells he has been saving up all winter, and distribute them broadcast all over the whole tract of land he proposes to improve that year. These shells are clean, and fall right alongside the mother oysters previously deposited. The chances are fair for catching spawn. Sometimes the same plan is pursued with seed that has grown sparingly upon a piece of ground; or young oysters are scattered as spawners, and the owner waits until the next season before he shells the tract. Sometimes the ground must be cleaned before any preparation can be begun upon it, by elaborate dredging, or otherwise. Within the harbour, for instance, considerable muddy bottom has been utilized by first paving it with coarse beach sand. No spot where there is not a swift current is considered worth this trouble. The proper amount is two hundred tons of sand to the acre, which can be spread at the rate of five sharpie loads a day, at no great expense. The sand forms a crust upon the mud firm enough to keep the oyster from sinking, and it need not be renewed more than once in five years.

Expenses of an Oyster Farm.

In either case, therefore, the planters expense has not been enormous. Two statements are herewith presented of the outlay under the operations outlined above, which are as follows:—

No. 1.—Fifty acres.

2,000 bushels spawners at 30 cents	$	600 00
15,000 bushels shells at 3 cents		450 00
Planting 15,000 bushels shells at 4 cents		600 00
Total	$	1,650 00

No. 2.—Sixty acres.

2,000 bushels of spawners at 56½ cents	$	1,130 00
17,000 bushels shells at 4 cents		680 00
4,453 bushels Bridgeport seed at 10 cents		445 30
Total	$	2,255 30

In third case Captain George H. Townshend gave a statement of the expenses to me of starting a farm of twenty-five acres off the mouth of East Haven river. This was a more elaborate arrangement, but, on the other hand, was accomplished through a

variety of favourable conditions, cheaper than would have been possible with the ground otherwise situated.

2,000 bushels small river oysters at 25 cents	500 00
Spreading same and staking at 5 cents	100 00
600 bushels dredged seed at 40 cents	240 00
10,000 bushels shells, put down at 4 cents	400 00
Total	$ 1,240 00

It would not be unfair to average the cost of securing, surveying and preparing the deep-water beds at about $40 an acre, or about $4,000 for one hundred acres. To this must be added about two dollars an acre for ground surveys, buoys, anchors, etc. This starts the planter in his undertaking, and if these beds are in an exposed position they are liable to suffer loss by storms, shifting sands, etc.; if, on the otherhand, they are well protected by nature, there is the watching and attention to be given to them grounds, as the catching of the stock after it has matured, or the separating of the seed which must cost a further sum, but when once started, there are always oysters which are caught that can be marketed, so that you are killing two birds with one stone, catching the oysters and cleaning the ground.

Management of Oyster Farm.

Having secured a spat of young oysters upon the cultch which has been laid down for them, they are left alone until they attain the age of three, four or five years, according to the thrift and the trade for which they are designated, by the end of which time they have reached a large size and degree of fatness, if the season has been favourable. If, as is largely done by those planters who live at Oyster Point, the bivalves are to be sold as seed oysters to Providence river, or other planters, they are taken up when only two years old.

At any time before the end of May, the disturbance of the beds can do little harm, and the experience of the Connecticut oyster farmers shows that the thorough raking of the oyster beds, just before the spawning season, is a positive benefit. The young bivalves cannot attach themselves to dirty and slimy shells, and if all the sponges, hydroids and seaweeds could be dragged from our beds in April and May, and if the old decayed and slimy shells could be ploughed under and covered with cleaner shells from below the surface, by dredging just before the spawning season, the fertility of the beds would be greatly increased, and there is, therefore, nothing in the nature of the oyster to demand the closure of the beds in April and May.

Enough instances have been given to show that the prohibition of dredging will not save any bed which can be reached with tongs, and as the dredge is a much more scientific, effective and economical apparatus than the tongs which it has superseded, there does not seem to be any reason why its use should be prohibited. In one way the use of dredges is a positive advantage to the beds. The dead shells which are found on an unworked bed are usually so covered with sponge, slime, and other substances, that they furnish no clean surface for the attachment of spat; and as dredging tends to turn up clean shells, to break up and scatter the clusters and to tear away the sponges and other foreign bodies, it is a positive benefit to the beds; the teeth of the dredge take hold of the rank growth of the beds, and by being dragged through *them* loosen and give *them* room to grow and mature properly; moreover, beds are continually increased in size, for when the vessel runs off the beds with the nets filled with oysters, the oysters and cultch are dragged off on ground where no oysters existed, and thus the beds are extended; and when the vessel is wearing or tacking to get back on the oyster beds, the catch just taken is being culled out, the cullings thrown overboard forming new cultch for drifting spat to adhere to. Many persons who do not advocate the total prohibition of dredging, believe that the size of the dredging boats, and the size and the

weight of the dredges should be restricted by law. They give two reasons why the size of the boats should be restricted, urging that the large boats are able to work on the beds when the police boats cannot venture out, and that their size permits them to use very large dredges, and thus catch great quantities of oysters.

It is asserted that the use of large dredges causes much evil, as they ruin the beds by crushing or smothering or burying in the mud more oysters than they capture; but the private farmers of Connecticut find it to their advantage to use much heavier dredges, and their farms improve under this treatment, although very heavy dredges are hauled by steam over the beds, even in the spawning season.

The cause of the exhaustion of the beds is because the demand has outgrown the supply. There are only two possible remedies. Either we must diminish the demand by killing the packing industry, which has created it, or we must increase by artificial means the natural supply of oysters.

This industry has paid a profit of no less than 100 per cent, annually upon the capital invested in the business, while money thus invested in other states has paid an annual interest of more then 200 per cent.

One firm laid down two thousand five hundred bushels of shells. Several large growers have laid down as many as two hundred thousand bushels each. A still larger number have scattered a hundred thousand, fifty thousand, and twenty thousand each. There are about thirty steamers engaged in the business, besides a large number of sailing vessels. It does not admit of a doubt that the business of oyster growing, as carried on in the waters of the sound, is exceedingly profitable.

With regard to transplanting the oyster and its transportation, all experienced persons were of the opinion that delicacy in handling, and freedom from jars, concussions and shock of any kind, were desirable. Oysters when under hatches, have very frequently been killed by heavy thunder storms and firing of guns. Any sudden shock or concussion will prove destructive, if they are in a confined space. Oysters taken up during the summer are much more susceptible to injury from this cause than those obtained during the winter.

Oysters are transplanted at any and all seasons, but generally in the spring and the autumn.

Here is an extract taken from the New York Fishing Gazette of the 23rd of last December, which reads as follows:—

An oyster farm of 920 acres in Normini Creek pays the State of Virginia $920 a year.

It was started three years ago, and $10,000 has been spent in planting. The present value of the farm is estimated at $50,000. From a ten acre farm in the Machodock, Virginia, $2,000 worth of oysters have already been sold this year. Virginia farms are getting seed oysters from Maryland which the laws of Maryland will not permit to be cultivated in this state. Tongers in Virginia are making more money taking oysters for the planters, than they can in taking them from the natural beds.

December 30. The establishment of oyster culture in Virginia has put it ahead of Maryland as the leading oyster state. The Maryland yield has decreased from ten million, five hundred and sixty-nine thousand and twelve bushels in 1880, to five million, six hundred and eighty-five thousand five hundred and sixty-one in 1901. During the same period the Virginian yield increased from six millions, eight hundred and seventy-three thousand three hundred and twenty bushels to seven millions eight hundred and eighty-five thousand four hundred and forty-seven bushels, of which about three-fifths came from the oyster farms. The comparative results as regards state revenue stand sharply out in the following table:—

1901	Maryland	$74,974	Virginia	$46,044
1902	"	73,359	"	51,618
1903	"	59,665	"	62,625
1904	"	39,989	"	68,028

Disbursements in 1904 amounted to $241,202 in Virginia and $62,628 in Maryland, a deficit of $22,364.

Private Oyster Culture.

The maritime provinces are equally adapted for the cultivation of oysters, and there is no reason why they should not prove as successful in our waters as elsewhere. The Marine and Fisheries Department granted leases some years ago, and an interest was being taken in this branch of industry until about six years ago.

On the 31st December, 1897, forty leases were held as follows :—

Quebec	held 2 leases containing	472	acres.
New Brunswick	held 2 leases containing	74½	acres.
Nova Scotia	held 12 leases containing	74¾	acres.
Prince Edward Island	held 17 leases containing	46	acres.
British Columbia	held 7 leases contai ing	142½	acres.
British Columbia	Indian reservation	365	acres.
	40	1147¾	acres.

So a start had been made in the right direction, and I would like to see the time when all available water area is taken up and converted into private oyster beds, as it must bring in a source of wealth, perhaps small at first, but if carried on successfully it means a large item both as regard profit and labour.

The Soil.

Oysters cannot thrive where the ground is composed of moving sand, or where mud is deposited ; consequently, since the size and number of suitable places are becoming very limited, only a very small percentage of the young oysters can find a resting place, and the remainder perish. By putting down proper cultch, immense quantities of the wandering spat (or fry) may settle on it, and thus be saved.

The conditions suitable for oyster culture vary, in different localities and with different classes of oysters, but the general requirements may be said to be a suitable soil, consisting preferably of a bed of shells superimposed on hard mud or clay, an absence of sand, and of five fingers, dogwhelks, crabs and other enemies of the oyster, a tidal flow ; and a certain admixture of fresh water, varying according as the bed is required for breeding purposes, or mainly as a fattening ground. In some cases oysters grow abundantly on rocky ground, and it is impossible to say generally, without a full knowledge of the circumstances of each case, how far any area may, or may not, become a likely oyster ground.

An area with a smooth surface laying in about four or six feet at low water, or up to twelve or fifteen feet will not hurt, the water should be sufficiently deep, so as not to allow the ice to rest on the beds, but where they are covered by ice and a current of water running between the bottom and the ice, the oysters are protected from the weather and are considered safe. The shallower the water the easier the labour, but probably they would be safer from theft in deeper water.

After an area has been prepared the next step is to stock it, and it has often been observed that the removal of oysters from one ground to another has the general effect of improving both their flavour and their size. The spring of the year, before the hot weather sets in, is the best time for planting. By placing the oysters in shallow water during the spring and summer months, they will grow much faster than if placed in deeper water, as the sun causes the water to become much warmer ; the oyster being very sensitive to the action of light and heat which promotes a rapid growth. Oysters planted in the autumn are not so likely to thrive, as, owing to the change of soil and falling temperature, the oyster is not properly climatized before winter sets in, which very often proves disastrous. Oysters grow but little during the winter months, with the exception of getting thicker, consequently, it is all risk or loss, with little or no gain, although there are exceptions in every case. Young oysters taken in the spring will

have survived the winter, the change of water and temperature becoming warmer, gives the oyster every chance to live and grow.

In obtaining the necessary quantity of oysters for planting purposes, extreme care would be taken to secure them in a fresh condition, and if time will admit of it, to overhaul these oysters and brood very carefully, and if they are found to be in clusters they should be separated as much as possible, either from other oysters, shells, stones, or anything else they may have adhered to. This separation gives the oyster a better chance to grow into its natural shape, as oysters grow better singly than when in clusters or bunches. In securing the stock the size of the oyster should be considered, for which I give the following reasons:—Small or young oysters planted on a bed are preferable, as their growth alone will result in large proportionate returns and profits. A young oyster is not so likely to die when transplanted to another bed, as when older, nor is it any advantage to transplant a full-grown oyster unless for immediate use. In the oyster trade of this country one great advantage is the rapid growth of the bivalve, when, as is the case here, they are bought and sold by measure.

As a rule, oyster brood picked from an ebb-dry ground or above low-water mark, are much hardier than those taken from deeper water; and by removing them into deep water they would be secure from the heavy frosts which prevail around our shores; and the quality of these oysters is, as a rule, very good.

Great care should be taken of the spat, as the older it is, the hardier it becomes, and if the young are saved the future may be looked forward to by reaping a good harvest. The living and the dead shells of the adult oysters furnish the best surface for the attachment of the young; and for this reason the points where oyster beds are already established are those where the young have the most favourable surroundings and the best show for life. The beds thus tend to remain permanent and of substantially the same size and shape. It is well known that shell-fish of all kinds thrive best where the supply of lime is the greatest. The dead oyster shell is soon corroded and in a few years almost entirely dissolved by the sea-water, and I think this fact is another reason why the young oysters thrive best on a natural bed.

Cultch is the name given to the debris of shells, stones, etc., which are found at the bottom of the sea, on or near oysters beds, It has been the practice from time immemorial to supplement the natural supply by throwing down deposits of this sort on oyster grounds. Oyster and cockle shells make the best material for this purpose; in default of this, stones and pebbles may be used, the great point being that cultch, whatever it is composed of, should be clean, and for this purpose the shorter the time it is laid down before the spat falls the better.

Shells may be collected from oyster saloons and deposited near the shore, exposing them to the weather, the sun and rain, frost and snow will have the desired effect on them, they will be thoroughly cleansed of all organic or other matter, and when laid on the oyster beds are excellent spat collectors, they also serve to make a firm foundation in extending an area if required by the planter. Or they may be obtained from oyster beds, when fishing for oysters and laid on shore till required for use, or when enlarging an area may be deposited there each day as they are caught according to the discretion of those who have charge of the work.

In the United States large quantities of oysters are canned each year, and the shells are saved and returned to the water at the proper season. Another source of supply is the shucking, or opening the oysters at the packing houses, sending only the meat of the oyster to market, which is a large item saved in freight and the shells are again returned to the beds to act as spat collectors.

Oysters will spat in shallow water sooner than they will in deeper water, owing to the difference of temperature at different depths.

They will breed long before they are full grown, very probably in the first year of their age; certainly in the second. Their productiveness appears to reach its maximum at five or six years, and afterwards to decline; but much further observation is needed before any certain knowledge is acquired.

The state of the weather, however, has a serious influence on the spawn, and on the adult oyster power of spawning. A cold, wet and windy season is very unfavourable and a decidedly cold day will kill the spat, so that it will be seen that while in the embryonic state young oysters are very delicate and susceptible to cold. If the temperature of the sea suddenly drops many degrees, they all close their shells and fall to the bottom dead, just as a frosty night will 'nip up' and cause to fall off from the branches the delicate blossoms of fruit trees. If, on the contrary, the weather continues of a warm and equable temperature both day and night, and if it be at the same time calm, the young oysters will have a chance of taking up their positions on the various substances they love best, viz: stones, gravel, empty shells, living oysters, and other clean, hard substances.

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